ELECTRICAL REVIEW

FRIDAY
8 JULY 1960

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Variable Speed Drive for every industry

The Most Flexible Form of Instant Speed Control!

- A WIDE 20/1 SPEED RANGE
- ADJUSTABLE REGULATION
- DIRECT-ON STARTING
- CONSTANT TORQUE AND/OR CONSTANT H.P.
- SINGLE OR PARALLEL OPERATION OF MOTORS
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TYPICAL APPLICATIONS

PAPER · PRINTING · MACHINE TOOLS
PLASTICS · WIRE DRAWING · GAS BOOSTING
CHEMICAL · RUBBER · FOOD HANDLING
PACKAGING · IRON & STEEL · SHIPPING

Write for Publication No. N.V. 390

LANCASHIRE DYNAMO NEVELIN LTD

A Member of the Metal Industries Group of Companies

HURST GREEN · OXTED · SURREY · Telephone: OXTED 3361 · Telegrams: NEVELIN · OXTED

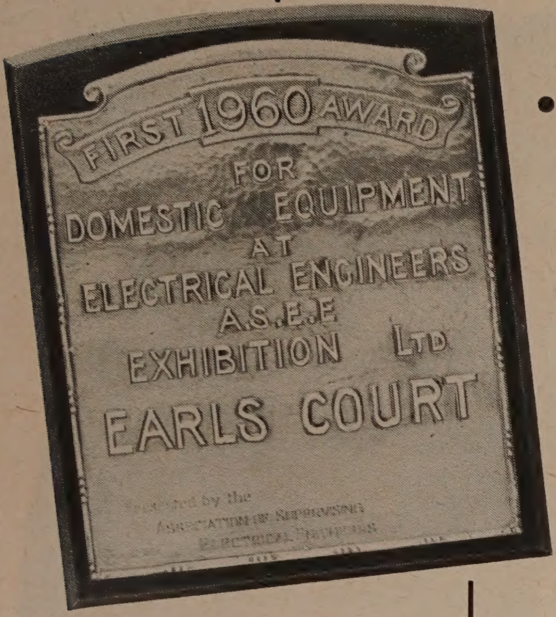
These flats at Westgate Street, Gloucester were wired exclusively with BICC Cables. Architects: City of Gloucester Architect's Department. Electrical Contractor: Lee Beesley & Co. Ltd., Gloucester.

There are 43 B I C C Branches throughout the British Isles, each fully stocked with Mineral, Rubber and Plastic Insulated Cables — ready for prompt delivery.

Modern Gloucester uses BICC wiring cables

BRITISH INSULATED CALLENDER'S CABLES LTD., 21 BLOOMSBURY STREET, LONDON, W.C.1

The year's most outstanding item of domestic equipment!*

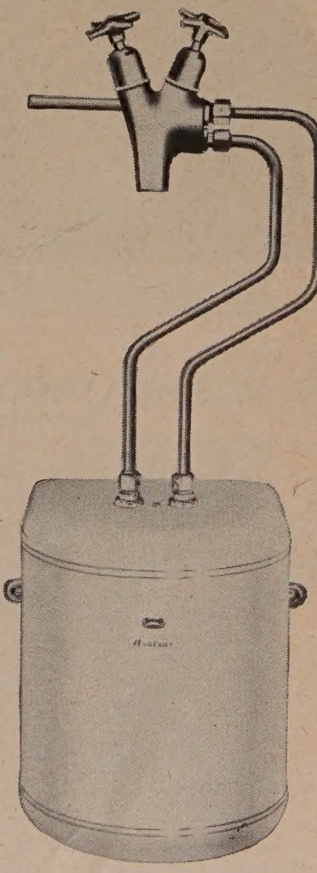


Heatrae Lidomatic

ELECTRIC HOT WATER SYSTEM

The Heatrae Lidomatic Automatic Hot Water System won the first award at the 1960 A.S.E.E. Exhibition and was judged the year's most outstanding item of domestic equipment. This distinction carries with it this silver plaque to commemorate the award.

The Heatrae Lidomatic system is designed for kitchen, bathroom or bedroom washbasins. The Lidomat Water Heater, which is the basic unit for the whole range of Lidomatic systems, is available in white, cream or grey, and is rated at 3,000 watts. Voltages are 200/220 or 230/250 A.C. only.

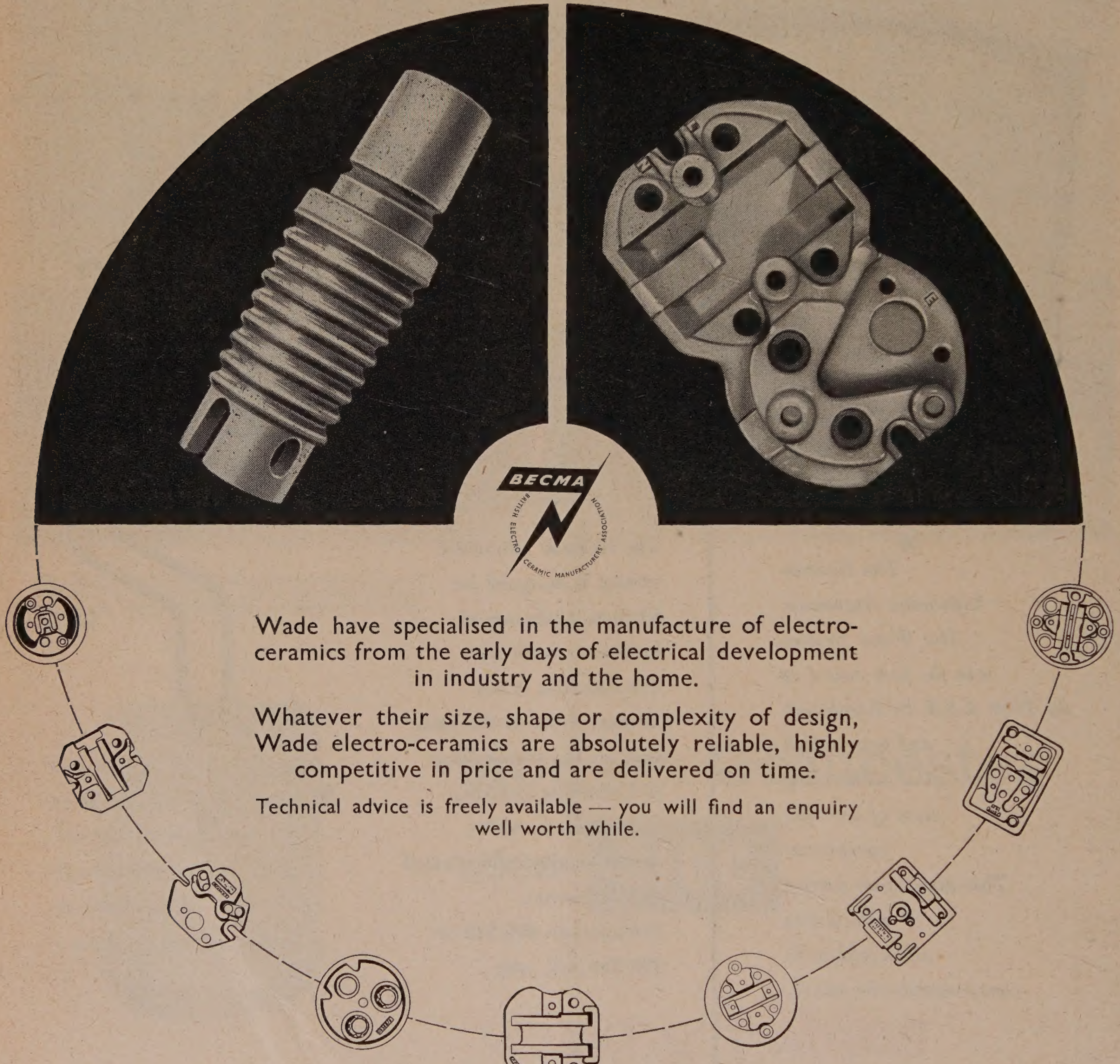


Please write for
LEAFLET No. 99

HEATRAE LTD · NORWICH · NOR 29A
Telegrams: HEATRAE, NORWICH Telephone: Norwich 25131 (Private Exch.)

WADE

ELECTRO-CERAMICS



Wade have specialised in the manufacture of electro-ceramics from the early days of electrical development in industry and the home.

Whatever their size, shape or complexity of design, Wade electro-ceramics are absolutely reliable, highly competitive in price and are delivered on time.

Technical advice is freely available — you will find an enquiry well worth while.

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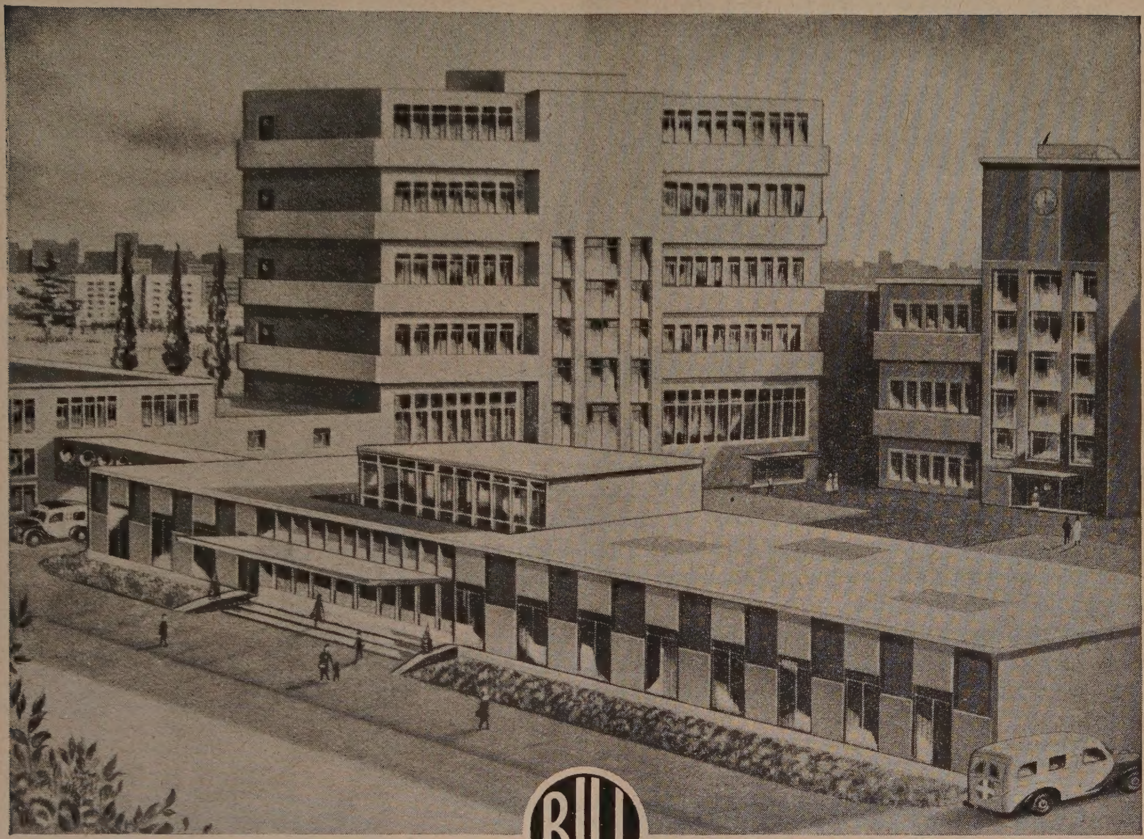
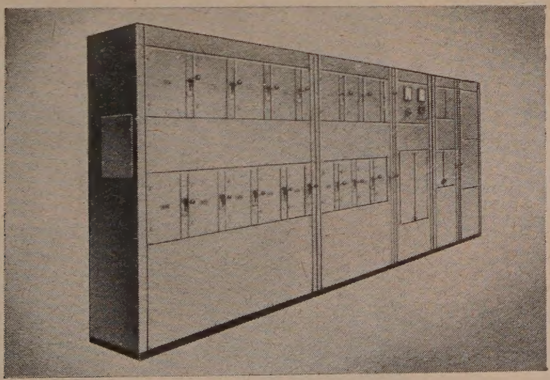
WADE (ULSTER) LTD., PORTADOWN, NORTHERN IRELAND

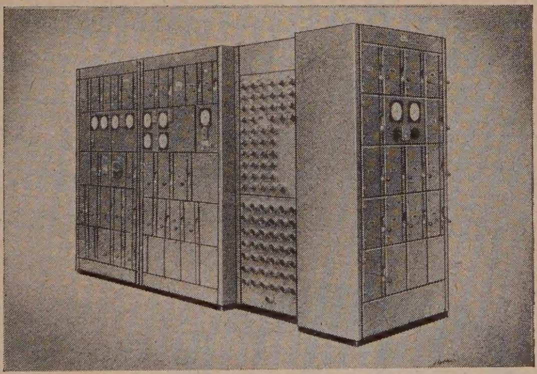
Members of the WADE *Group of Potteries*

You cannot buy better gear



The Modern Switchgear – for Modern Buildings





MAJESTIC MEDIUM VOLTAGE SWITCHBOARDS ARE BEING SPECIFIED WITH EVERY CONFIDENCE BY LEADING ARCHITECTS, CONSULTING ENGINEERS, ELECTRICITY BOARDS AND INSTALLATION ENGINEERS FOR MODERN TECHNICAL COLLEGES, HOSPITALS, CIVIC AND INDUSTRIAL BUILDINGS.

★ WRITE FOR A COPY OF OUR LATEST BROCHURE MVS.460.

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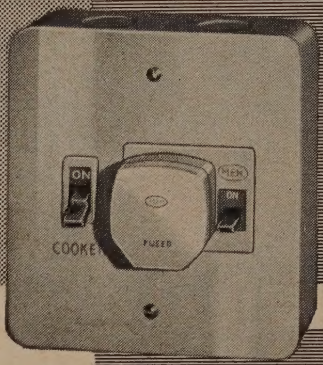
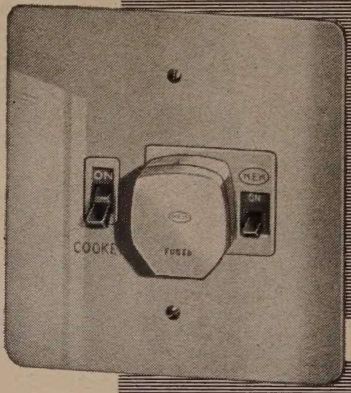
Control Units for the modern electric cooker



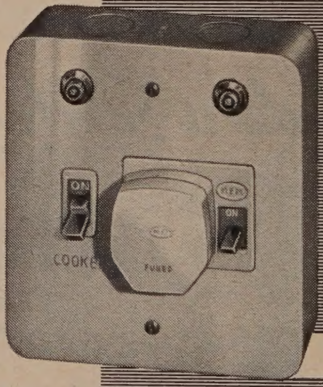
130 CCS

Rated at 30 amps, 250 volts, single phase A.C. only, the M.E.M. Cooker Control Unit is the ideal electricity control for the modern electric cooker, and provides for interchangeability of units as called for by B.S.1833.
The unit comprises a 30 amp 250 volt D.P. (A.C. only) switch for control of cooker, and an independent auxiliary circuit which includes a 13 amp 3 pin (flat) socket outlet with D.P. switch and complete with 13 amp moulded ivory fused plug.
Flush and Surface patterns are available in sheet steel enclosure, rust proofed, and finished in stove enamel ivory. Models can be supplied with or without two neon pilot lights.



130 CCF

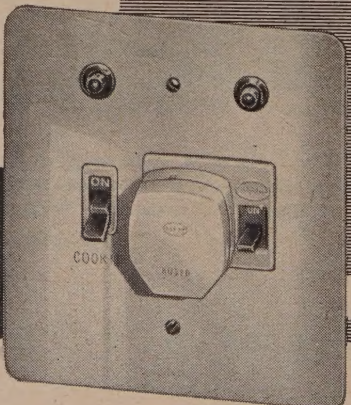
- *One-piece interior simplifies wiring.*
- *Porcelain one-piece base eliminates "tracking".*
- *Good earthing facilities.*
- *Ample provision for conduit entries.*
- *Interior adjustment to correct any mis-alignment during installation.*
- *Clear semaphore indicators.*
- *Pilot lights clearly seen at all angles.*



130 CPS

MEM

Cooker Control units



130 CPF

Write for illustrated list No. 437R

MIDLAND ELECTRIC MANUFACTURING CO. LTD.,
TYSELEY, BIRMINGHAM 11

SEMICONDUCTOR RECTIFIERS

Milliwatts or Megawatts?

Germanium or Silicon?

AEI offers a
complete range of devices, assemblies, and power installations

TYPICAL STANDARD RATINGS

	Max. Current
Germanium, point-contact	30 milliamp
Germanium, gold-bonded	100 milliamp
Silicon, 10kV, potted	500 milliamp
Germanium, stud-mounted	750 milliamp
Silicon, wire-ended	1 amp

	Max. Current
Silicon, stud-mounted	2.3 amp
Silicon, stud-mounted	10 amp
Germanium, fin-mounted	60 amp
Silicon, fin-mounted	150 amp

Standard potted units and stacks from 600 milliamp. to 1500 amp.
Complete power rectifier installations of any size for any application.

Write for technical data to:

Power Rectifier Sales or **Semiconductor Sales**

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A5560

Cables used for your entertainment..

A typical scene in a television studio, by courtesy of the B.B.C.

In a television studio there are cables all over the place.
Your programme depends on these cables being reliable.
We have supplied the B.B.C. and manufacturers with cables for every purpose.
Let reliability decide your choice of cables.

Our range includes —

- *Aluminium Overhead Cables*
- *"CORRUSTEEL" Armoured Cables*
- *"WANDOVERPLAS" Overhead Cables*
- *"FLORAWARM" Floor Heating Wires and Cables*
- *"HITEM" Heat Resisting Thermoplastic Cables*
- *and a full range of all Domestic Wires and Cables*
- *Also a Complete Range of PTFE insulated wires for operation up to 250° C*
- *"REFRASIL" Cables operate at 1,000° F*

WANDLESIDE CABLES **for every purpose**

WANDLESIDE CABLE WORKS LTD. 106 GARRATT LANE WANDSWORTH LONDON S.W.18

An independent company in Association with Irish Cables Ltd. and Wandleside Warren Wire Co. Ltd., all in the FALKS group

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INFINITE SPEED CONTROL

INCREASES PRODUCTIVITY

Welding manipulators driven by 3-h.p. 2160/540 r.p.m. motors. Hand-operated brushgear is provided for the machine in the foreground and pilot motor operated speed adjustment for the other, giving the exact speed required for the welding conditions.

How is infinite speed control best achieved? By installing Fuller A.C. Variable Speed Commutator Motors. Our illustration relates to steel fabricating but these motors can be applied to any industrial process.

The *INFINITE variable speed* characteristic of the Fuller A.C. Commutator Motor means that your machine can be operated at *precisely the exact speed* to give maximum output of quality and quantity. The speed required is maintained irrespective of normal load variation. Commutator Motors require no resistance or external regulator; current consumption is reduced at lower speeds bringing savings in power costs.

We shall be glad to explain how your factory can benefit by using Fuller Commutator Motors.

consult-

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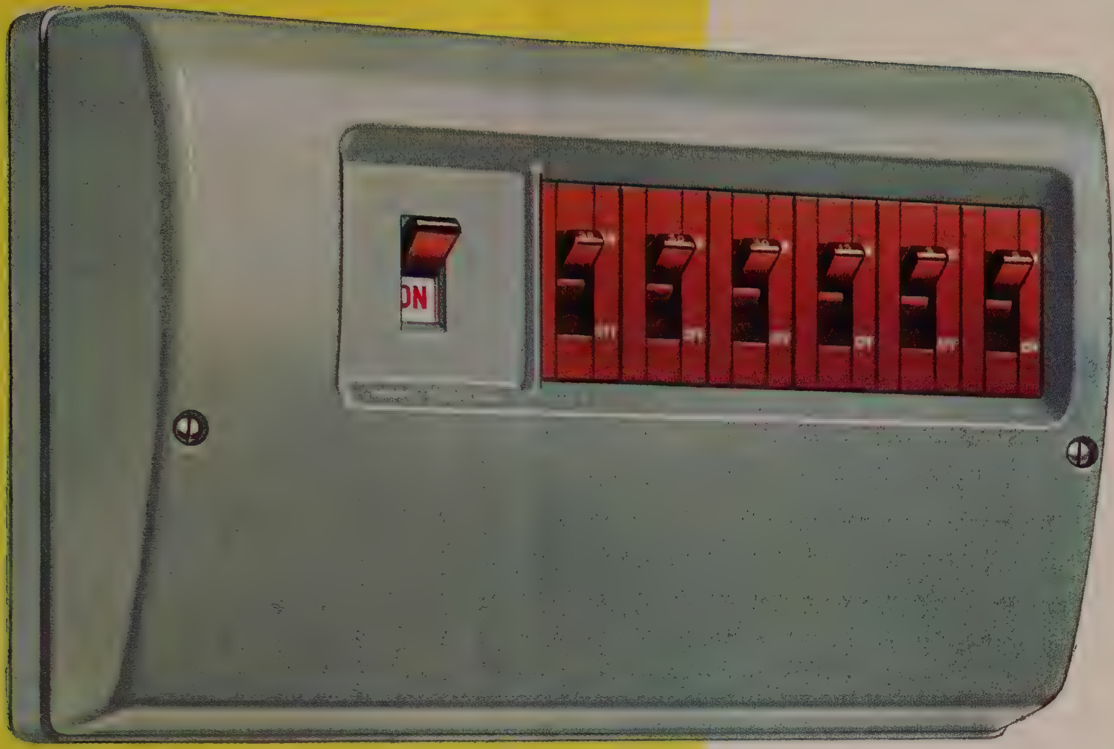
. . . and invite you to make use of our free technical service



Another dramatic Crabtree 'first'

- Built-in inverse current/time delay device prevents harmless transient overloads causing nuisance tripping.
- Instantaneous tripping under heavy overload or short-circuit fault conditions.
- Magnetic-hydraulic tripping ensures close and accurate protection against any form of sustained overloading.
- Neither minimum tripping current nor nominal current rating are affected by variations in ambient temperature.
- All ratings will maintain their accurate tripping characteristic after repeatedly clearing overload or short-circuit faults.
- In addition to the all-insulated consumer's unit a wide range of sheet-metal enclosures for both industrial and domestic installations, will be available.

Further technical information is available on request

For the first time an all-insulated consumer's unit embodying circuit-breaker protection will soon be available for the domestic installation

This unique Crabtree Consumer's Unit is designed to bring to the domestic user all the advantages of an entirely new miniature circuit breaker—the Crabtree Type C-50.

Although designed to give all the advantages of miniature circuit breaker protection at a domestic installation price, the Type C-50 provides the user with short-circuit and overload protection to a standard of reliability unrivalled even by units of a much higher price.

A series of rigorous proving tests have shown that the Type C-50 circuit breaker may confidently be recommended for dealing with any fault conditions likely to arise on any domestic or other normal installation.

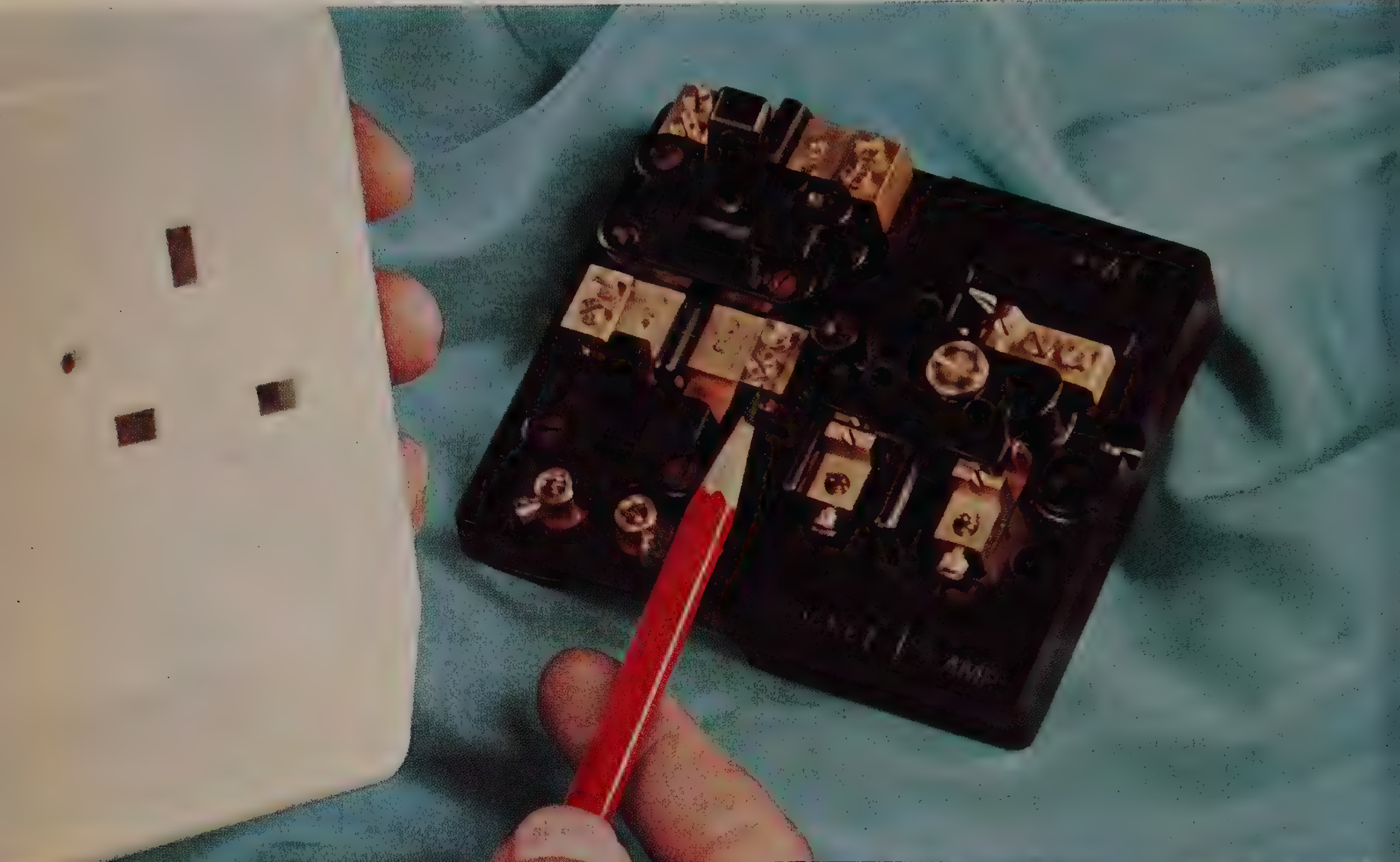
CRABTREE

C.802

J. A. CRABTREE & CO. LTD., LINCOLN WORKS, WALSALL

Wylex build quality

into Sonex Cooker Units



Admired by consumers for attractive, easy-to-keep-clean design Sonex Cooker Units demonstrate the extra WYLEX quality in every feature. Electricians appreciate the 45 amp. rating, and the reliability of the *proven* WYLEX switch.

The Sonex range of Cooker Units includes All-Insulated 45 amp. (with or without Pilot Light) and All-Insulated 60 amp. Also Metalclad Surface and Flush 45 amp. All with B.S. 1363 outlet.

WYLEX

Wylex build quality into...

SWITCHES · SWITCHED SPUR BOXES · COOKER UNITS
SWITCH FUSE CONTROL UNITS · PLUGS & SOCKETS

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Two 300 MW sets for Lakeview, Ontario

From an original drawing supplied by the Hydro Electric Power Commission of Ontario

THIS artist's impression shows the Lakeview Generating Station now being built beside Lake Ontario. With its planned capacity of 1,800 MW, it will be one of the world's largest thermal-electric plants. Two 300 MW turbine-generators have been ordered from AEI and the first will be installed in 1963. These generating sets, like all AEI equipment, will incorporate advanced design based on long experience.

The AEI turbo-generators for Lakeview will have hydrogen-cooled rotors, and the system of water cooling of stator windings first developed by AEI engineers. The four-cylinder single-axis turbines will operate at steam inlet conditions of 2,350 psig and 1,000°F, with reheat steam at 1,000°F.

For further details, write to AEI Turbine-Generator Division, Trafford Park, Manchester 17, or to your local AEI Office

AEI

Turbine-Generator Division

Associated Electrical Industries Ltd.

MANCHESTER & RUGBY, ENGLAND · GLASGOW, SCOTLAND
LARNE, NORTHERN IRELAND

B/A 003

SMOOTH FLEXIBILITY . .

IS NEEDED IN SMALL CABLES. You have it in RIST'S flexible cables and cords.

What is more, the smooth flexibility of RIST'S production ensures a full range of cables and CABLE ASSEMBLIES made to your requirements.

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RIST'S WIRES & CABLES LTD.
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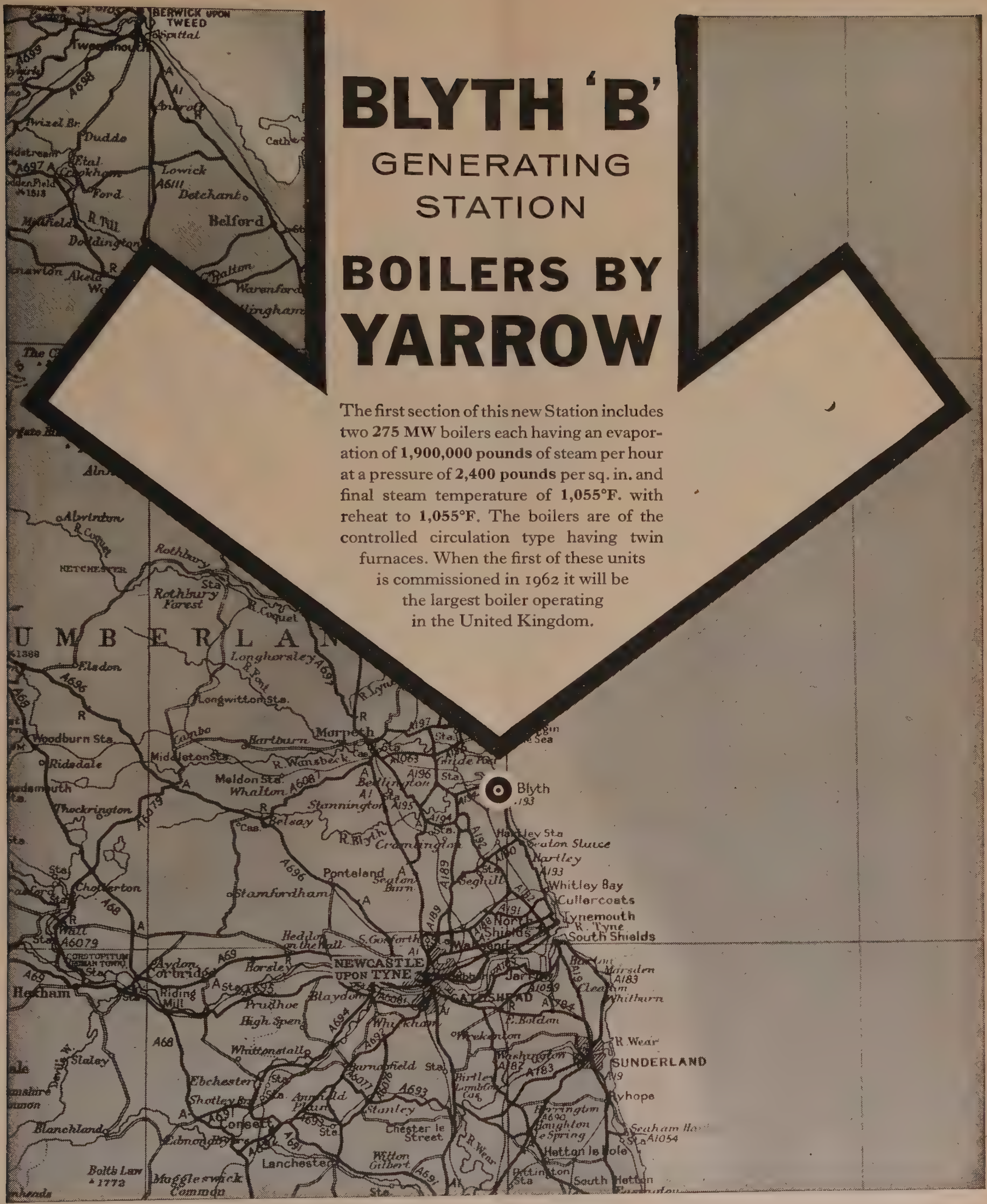
Sole London Distributors: LYMELITE ELECTRICAL INDUSTRIES LTD.
130/4 PENTONVILLE ROAD, LONDON, N.1. TELEPHONE: TERminus 9631/2



BLYTH 'B'
GENERATING STATION
BOILERS BY YARROW

The first section of this new Station includes two **275 MW** boilers each having an evaporation of **1,900,000 pounds** of steam per hour at a pressure of **2,400 pounds** per sq. in. and final steam temperature of **1,055°F.** with reheat to **1,055°F.** The boilers are of the controlled circulation type having twin furnaces. When the first of these units is commissioned in 1962 it will be the largest boiler operating in the United Kingdom.

YARROW

YARROW & COMPANY LIMITED · SCOTSTOUN · GLASGOW · W.4

In addition to the **HAWKE** Flameproof and Weatherproof Junction Boxes and Cable Glands for Single Wire Armoured Cables

we **now** manufacture a
HAWKE GLAND
for all types of
DOUBLE Wire Armoured Cables

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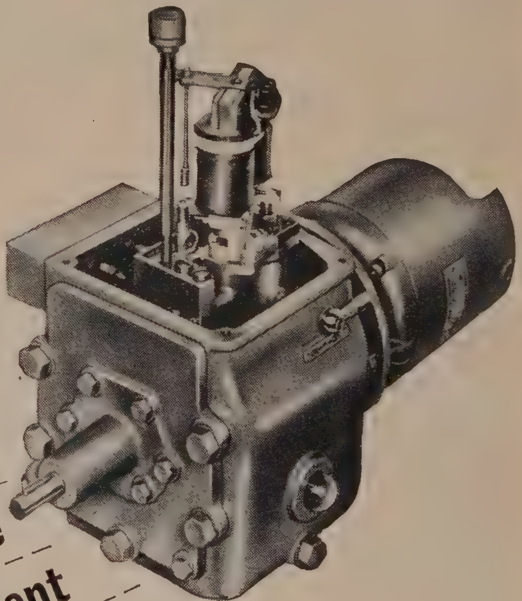
The Isenthal Automatic Regulator type "N.C." is probably the most completely versatile control unit obtainable. There are types available for regulating all sizes of generating or processing equipment to satisfy a variety of conditions, either automatically, or as part of user's control system.

The "N.C." Regulator is simple to operate and adjust, and requires the minimum of maintenance. It may well be the answer to your automatic process control problem. Our engineers are at your service to discuss your problem with you and are ready to call at your request.



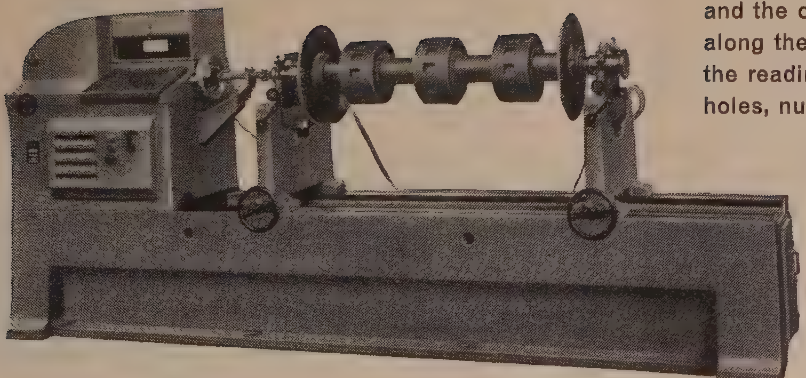
with **ISENTHAL**

Please send for illustrated descriptive leaflets.
Isenthal & Co. Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. Tel. ACOrn 3904. Grams: Isenthal, London.

Too Many Vibrations

Unevenness in shaft surface, building vibrations, echoes from near-by machines, small eccentricities in the roller . . . And, somewhere in between, the unbalance oscillations you want to detect.

How to sort the vital vibrations from the strays is one of the problems of dynamic balancing solved by the AVERY Wattmeter system . . . and without resorting to filter circuits needing elaborated tuning. The machine shown here swiftly indicates the amount of unbalance and the compensation necessary in any two planes along the rotor length. Suitable calibration converts the readings into units of correction (depth of drill holes, number of compensating weights etc.).

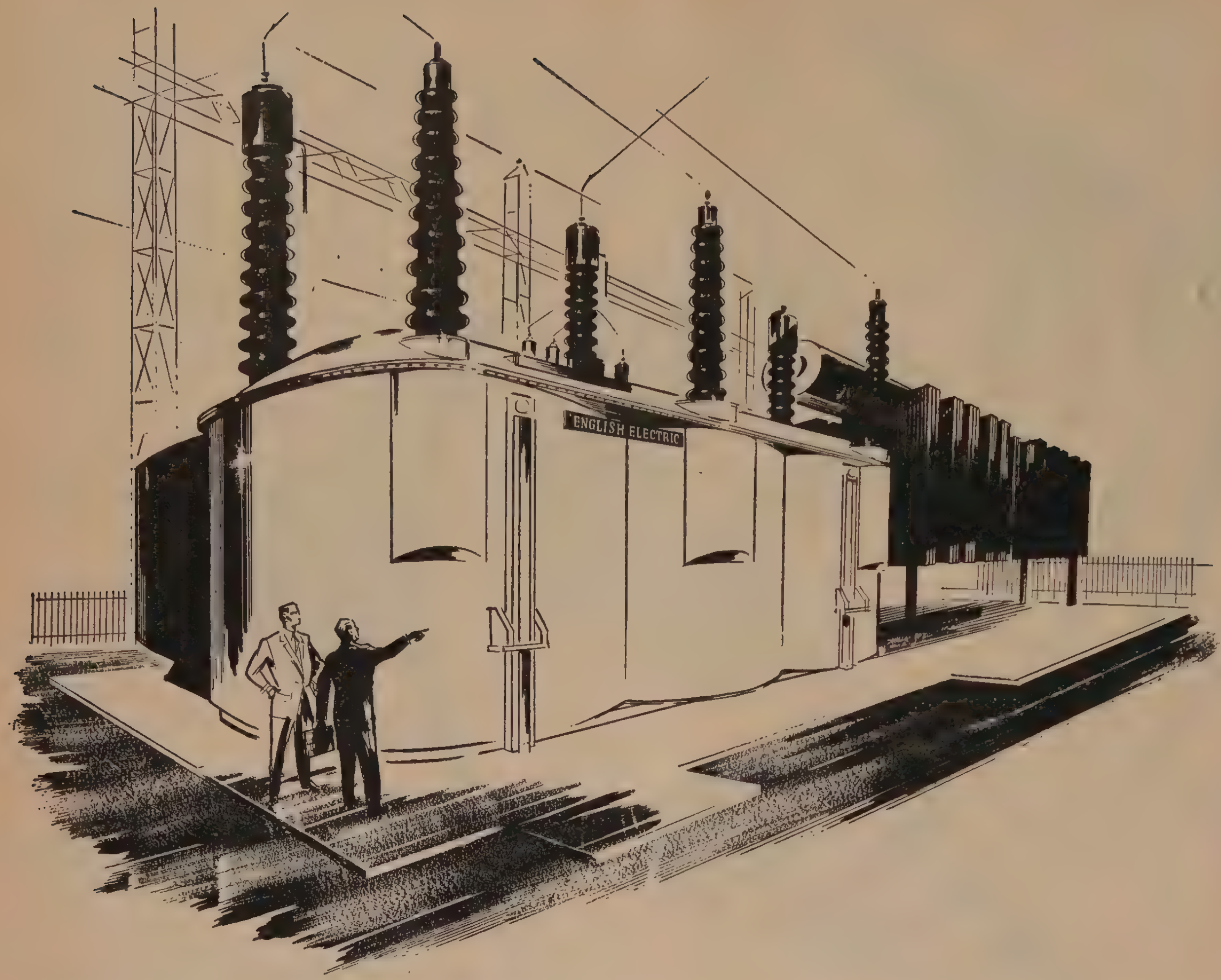


By designing the rotor for balancing, advantage can also be taken of this machine's ability to calculate correction required at pre-selected points.

Send for illustrated booklet.
Write to the address below,
quoting reference **ER2**.

AVERY for **ELECTRODYNAMIC BALANCING**

W. & T. Avery, Limited, Birmingham



380 kV 400 MVA auto-transformer for Great Britain

The ENGLISH ELECTRIC Company Limited has received instructions from the Central Electricity Generating Board to put in hand a 400 MVA 380/275 kV 3-phase ON/OFB auto-transformer which is to be installed at High Marnham. This transformer is of the highest rating and voltage yet ordered for Great Britain.

'ENGLISH ELECTRIC' has design, manufacturing and testing capacity for transformers of any envisaged size and voltage.

'ENGLISH ELECTRIC'

transformers

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2
Transformer Department, Stafford
TFS.30 WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

NEVER FORGET

WOOTTON

METER BOARDS ARE BEST!

Here's a trunk call coming through for all meter board users: "Wootton tested boards are extra tough, and combine strength plus reliability under all climatic conditions"—and don't forget WOOTTON wood blocks, sunk switch boxes and instrument cases

WOOTTON & CO. LTD.
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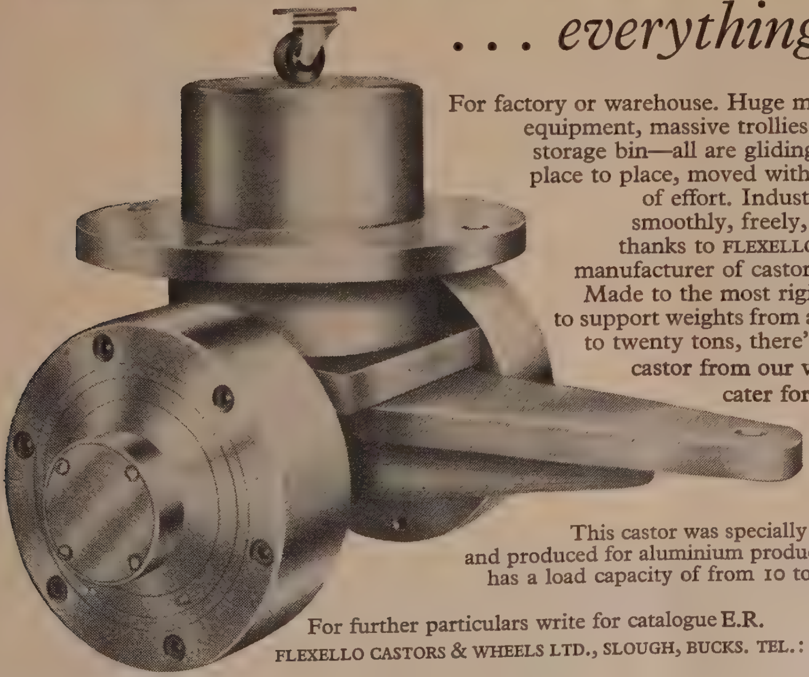
MASSIVE OR MIDDLEWEIGHT...

... everything flows freely on

Flexello

constant quality castors

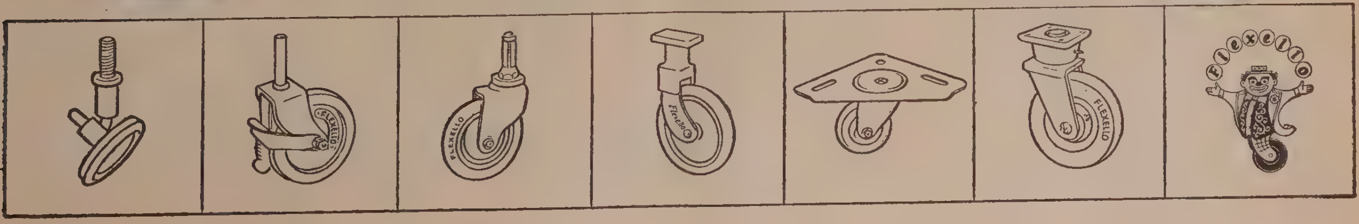
For factory or warehouse. Huge mobile testing equipment, massive trollies, the lightest storage bin—all are gliding easily from place to place, moved with a minimum of effort. Industry is flowing smoothly, freely, efficiently—thanks to FLEXELLO, the largest manufacturer of castors in Europe. Made to the most rigid standards, to support weights from a few pounds to twenty tons, there's a FLEXELLO castor from our vast range to cater for all requirements.



This castor was specially designed and produced for aluminium production and has a load capacity of from 10 to 12 tons.

'44' SERIES CASTORS: A special series of *Double Ball Bearing* heavy medium duty castors, specially manufactured for export which have now become available for the home market.

For further particulars write for catalogue E.R.
FLEXELLO CASTORS & WHEELS LTD., SLOUGH, BUCKS. TEL.: SLOUGH 24121



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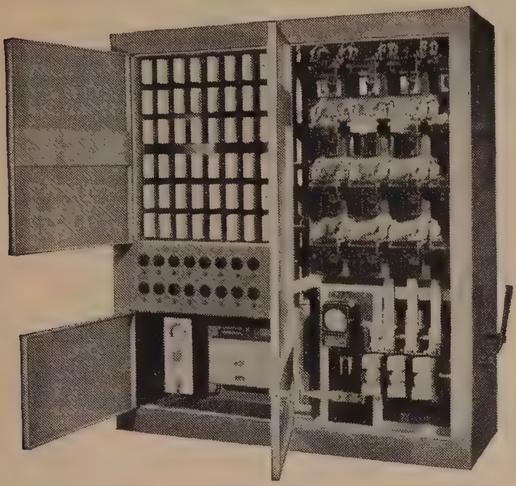
Heating Control Panels

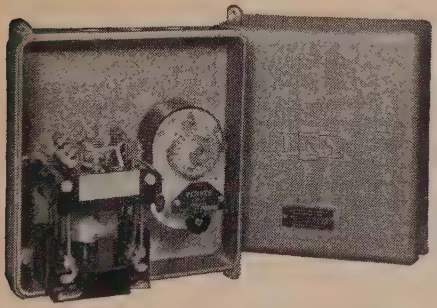
built to individual Specifications



THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities, the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

The panel illustrated handles 267 kW. and is divided into 16 zones with individual limit thermostats and overall control by time switch; together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.



Triple pole 30 amp. Contactor with Time Switch type MD1SP

CONTACTORS

- Comprehensive range of contactors for all types of thermal storage and space heating control — 10 to 350 amp. SINGLE, DOUBLE, TRIPLE AND FOUR POLE.
- FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier

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Head Office and Works: Chertsey, Surrey
Telephone: Chertsey 3467 Telegrams: Switchgear, Chertsey
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post this coupon TODAY!

To BRITISH KLOCKNER SWITCHGEAR LTD., CHERTSEY, SURREY
Please send me your list of Contactors for Heating Control
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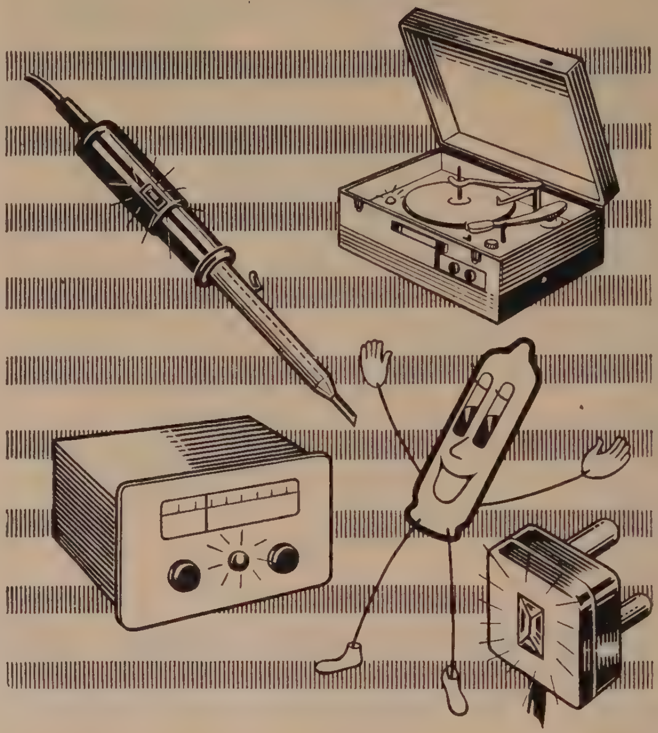
POSITION..
FIRM..
ADDRESS..
ER/1/7/60

For better indication— fit a Hivac neon



With its distinctive colour indication and almost indefinite life, a Hivac Neon is the best indicator for a wide range of domestic and industrial electrical equipment. Its easily-seen light serves as a visual check that an appliance is working as required. Look at the advantages:

- ✱ **Extremely long life without sudden failure**
- ✱ **No filament to break**
- ✱ **Inexpensive and easy to instal**
- ✱ **Shock resistant**
- ✱ **Negligible power consumption**
- ✱ **Operation on a wide range of A.C. or D.C. voltages**

It just glows to show!

There's a type for every purpose —write for full details

Hivac Limited Stonefield Way, South Ruislip,
Middlesex. Ruislip 3366

N6

Save stand-by battery space with the new CHLORIDE Stationary Cell

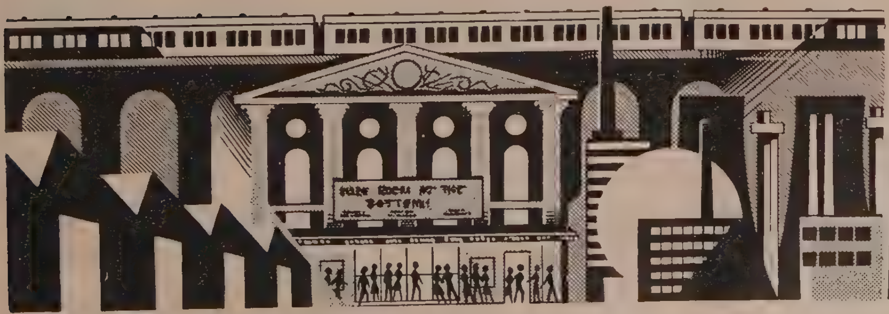
THIS LIGHT, robust cell, with its Planté positive and pasted negative plates, Porvic microporous separators and many other improvements in material and design, saves up to 50% of previously necessary battery space—yet performs its duties with greater efficiency and complete reliability. Specially designed for stand-by duties entailing discharge rates between, say, the 3-hour and the very high rates demanded for switch-closing purposes, it is ideal for trickle-charge operation and has all the remarkable length of life associated with the Planté type of construction.

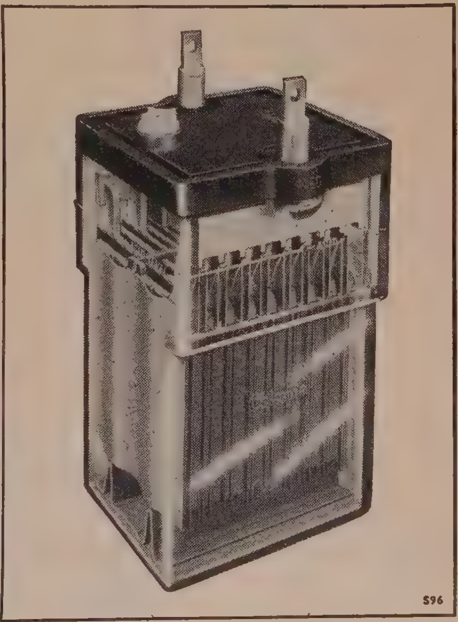
The field in which the new cell is designed to replace current Planté types is a very wide one. Emergency lighting*, switch operation and emergency supply in hospitals, theatres, cinemas and other public buildings, nuclear and conventional power stations, all rely on trickle-charged batteries. In Great Britain today such batteries occupy millions of cubic feet of valuable space. The new Chloride cell could free almost half of it.

*The new cell will from now onwards be fitted in all Keepalite units—the Chloride Company's automatic emergency lighting system.

A PRODUCT OF CHLORIDE BATTERIES LIMITED
BACKED BY WORLD-WIDE SERVICE

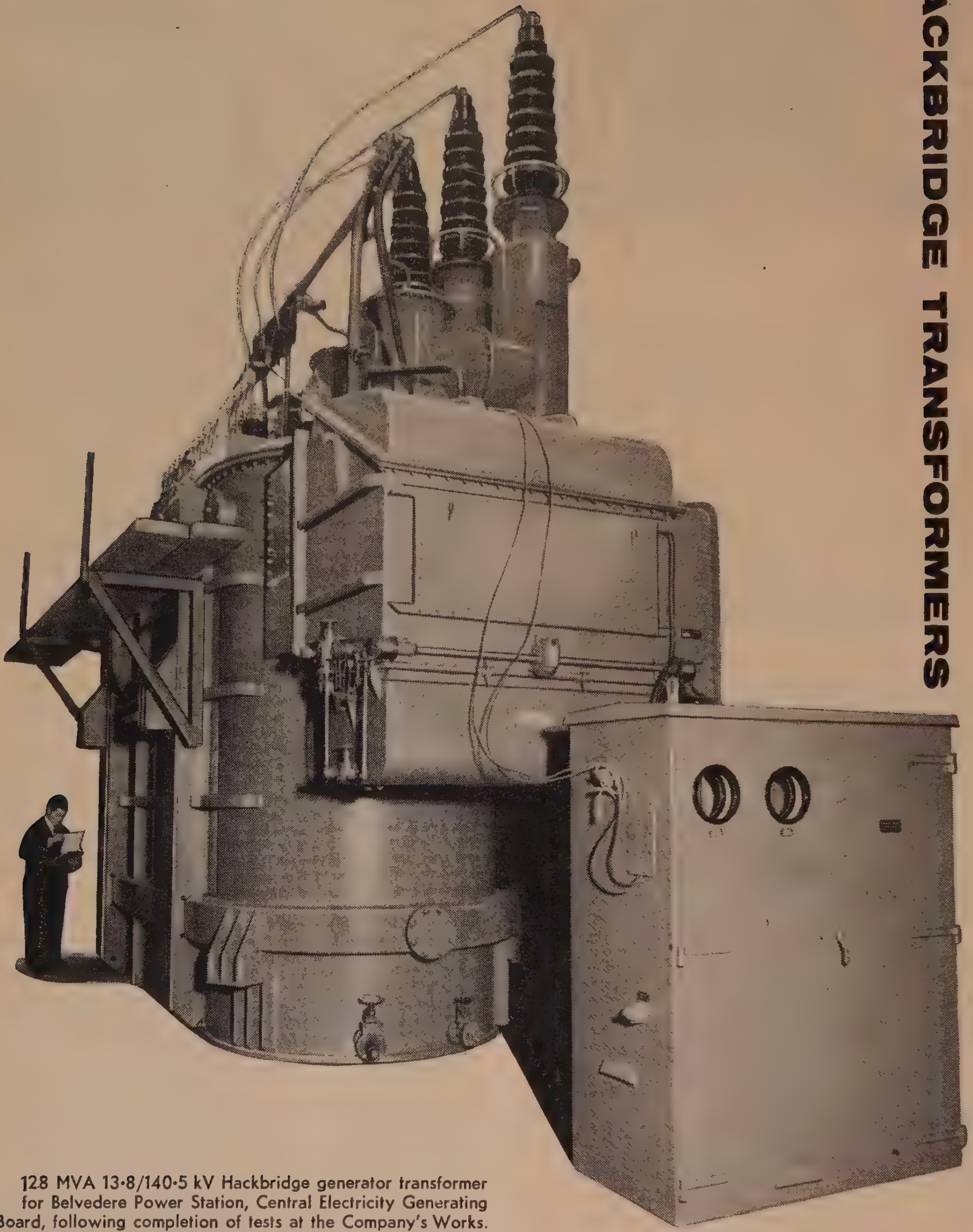
Makers of Exide Batteries





Enquiries to: London, Elgar 7991; Bristol 64086; West Bromwich 2361; Leeds 20248; Glasgow, Bridgeton 3734; Manchester, Blackfriars 1158; Belfast 27953

HACKBRIDGE TRANSFORMERS



128 MVA 13·8/140·5 kV Hackbridge generator transformer for Belvedere Power Station, Central Electricity Generating Board, following completion of tests at the Company's Works. Two 64 MVA and two 72 MVA generator transformers are also installed at this station and another 128 MVA is on order.

every type, size, and voltage

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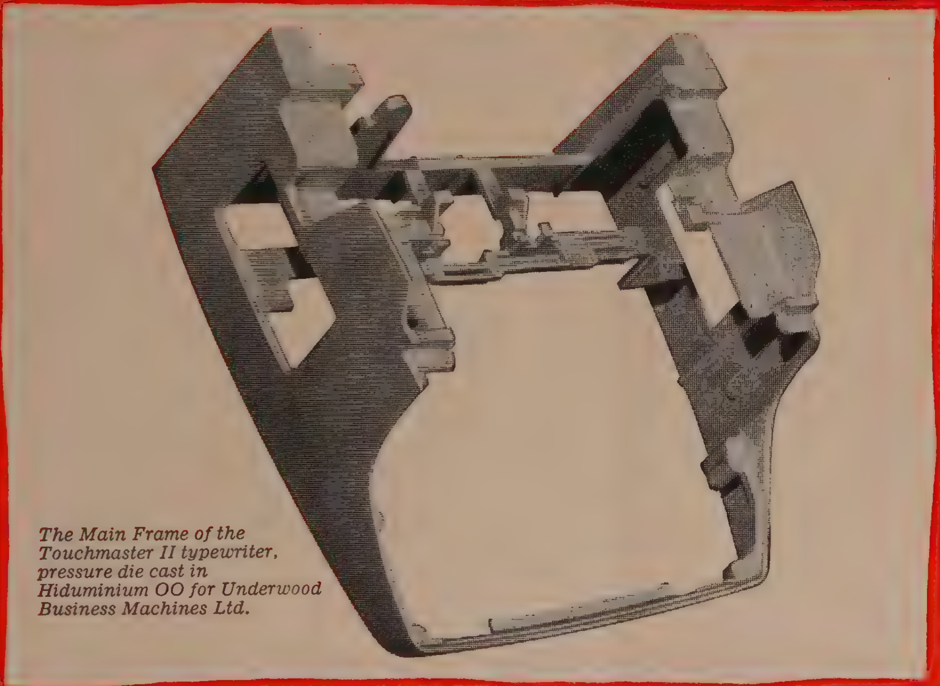
it can be done

Offset the rising spiral in production costs? It can be done. Hiduminium is doing it. This casting is typical of a number of components of intricate design which used to be assembled from many parts—but which can now be made in one piece as an H.D.A. Pressure Die Casting. You can turn a dozen operations into one—with Hiduminium alloys and H.D.A. Techniques.



The Main Frame of the Touchmaster II typewriter, pressure die cast in Hiduminium OO for Underwood Business Machines Ltd.

Hiduminium

makes the most of *Aluminium*

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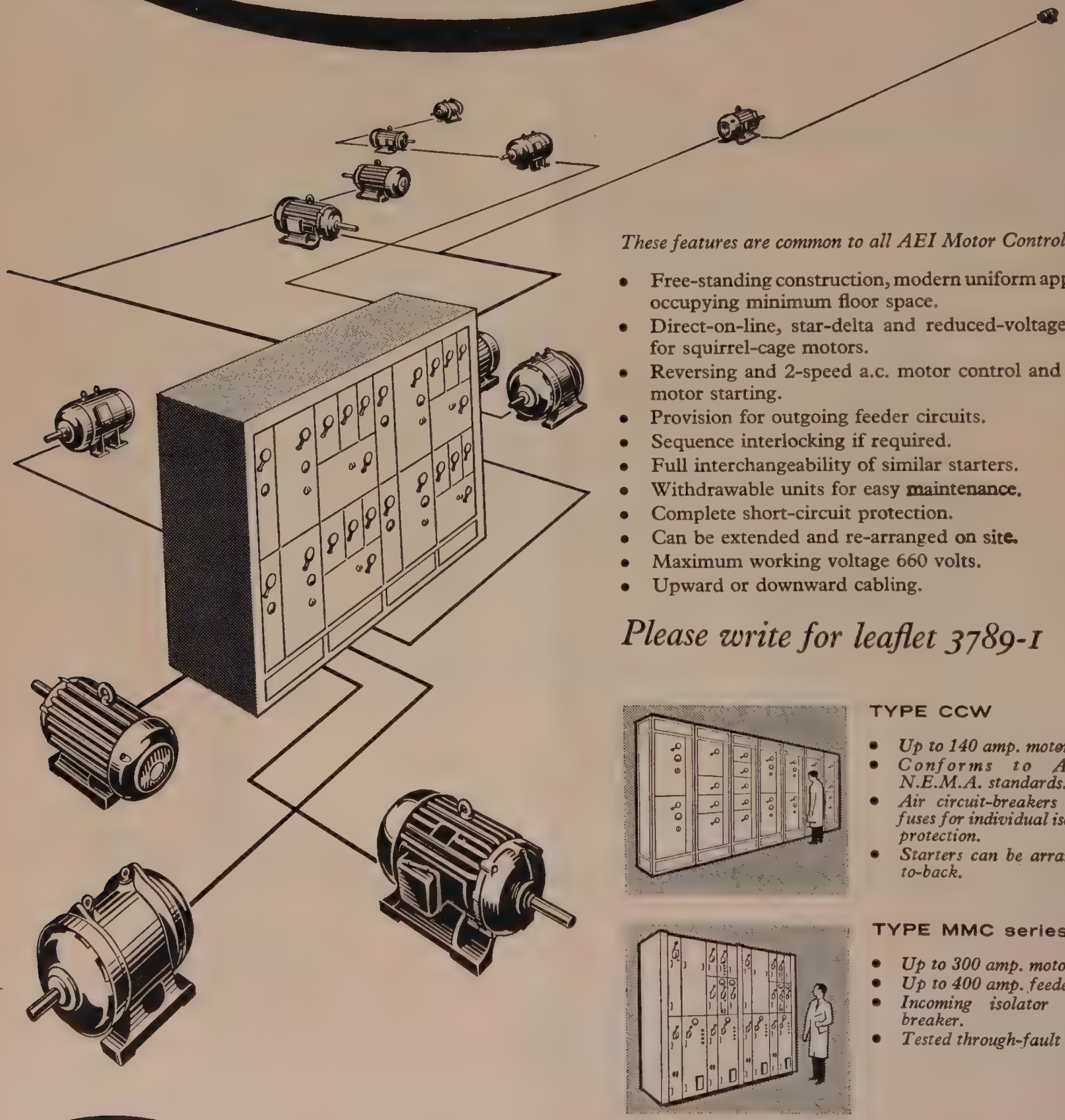
So many advantages with AEI Multi-motor control



These features are common to all AEI Motor Control Centres:

- Free-standing construction, modern uniform appearance, occupying minimum floor space.
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- Reversing and 2-speed a.c. motor control and slip-ring motor starting.
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- Withdrawable units for easy maintenance.
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- Can be extended and re-arranged on site.
- Maximum working voltage 660 volts.
- Upward or downward cabling.

Please write for leaflet 3789-1

TYPE CCW

- *Up to 140 amp. motor circuits.*
- *Conforms to American N.E.M.A. standards.*
- *Air circuit-breakers or switch-fuses for individual isolation and protection.*
- *Starters can be arranged back to-back.*

TYPE MMC series 1000

- *Up to 300 amp. motor circuits.*
- *Up to 400 amp. feeder circuits.*
- *Incoming isolator or circuit breaker.*
- *Tested through-fault capacity.*

AEI

Associated Electrical Industries Limited

Motor and Control Gear Division

RUGBY AND MANCHESTER

A5530

INCORPORATING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

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RUBBER MOULDINGS

For super-quality mouldings send your enquiries to John Bull. Mouldings to fine limits and in the correct hardness are supplied in natural or synthetic rubber to resist solvents, oils, chemicals, abrasives, ageing, high and low temperature conditions. Tasteless, odourless compounds for food, dairy, brewing and fine chemical industries are available. We will be glad to design components to meet your requirements.

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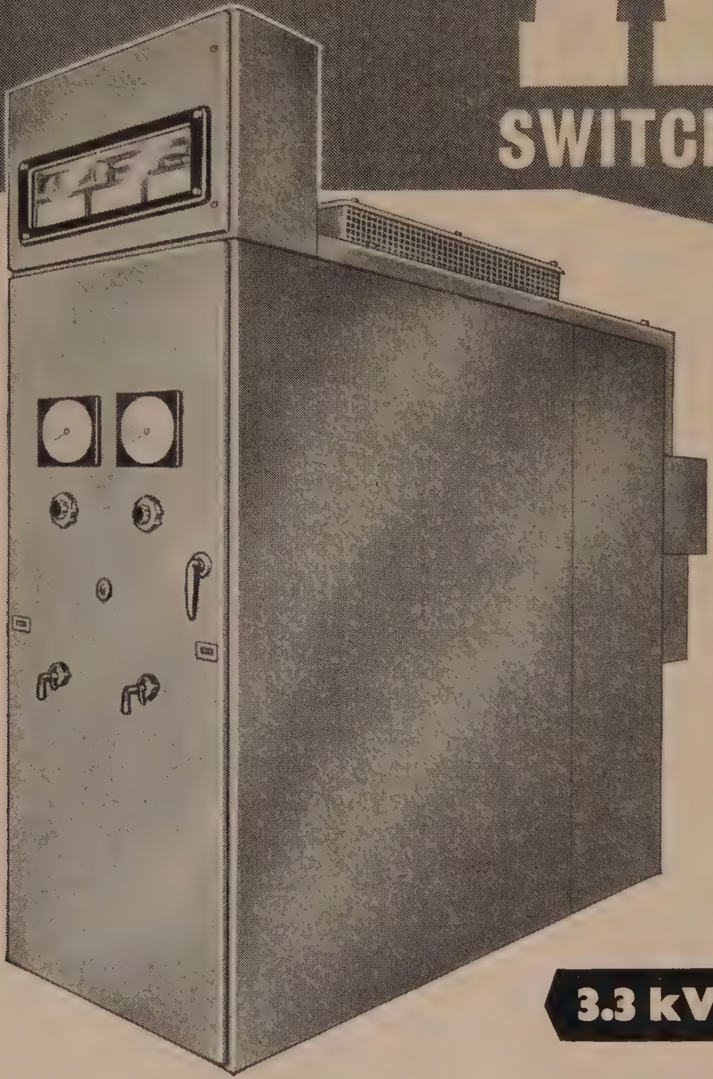
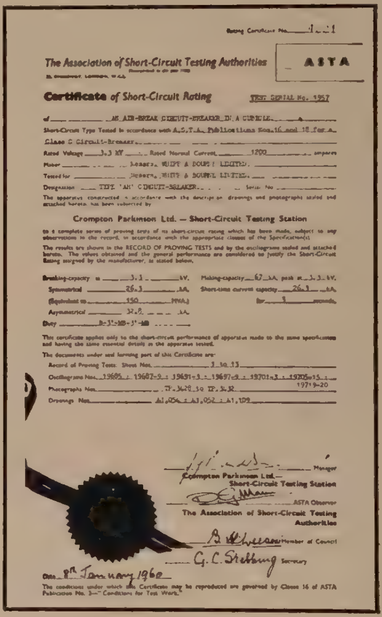
TRADE MARK

Air Insulated Air Break TYPE AH SWITCHGEAR UNIT





Rating Certificate No. [illegible]

The Association of Short-Circuit Testing Authorities — ASTA

Certificate of Short-Circuit Rating — TEST SERIAL No. 1957

of AH AIR-BREAK CIRCUIT-BREAKER IN A CUBICLE.

Short-Circuit Type Tested in accordance with A.S.T.A. Publications Nos. 16 and 18 for a Class C Circuit-Breaker.

Rated Voltage 3.3 KV Rated Normal Current 1200 amperes

Maker Messrs. WHIPP & BOURNE LIMITED.

Tested for Messrs. WHIPP & BOURNE LIMITED.

Designation TYPE 'AH' CIRCUIT-BREAKER. Serial No

The apparatus constructed in accordance with the description, drawings and photographs sealed and attached hereto, has been subjected by

Crompton Parkinson Ltd. — Short-Circuit Testing Station

to a complete series of proving tests of its short-circuit rating which has been made, subject to any observations in the record, in accordance with the appropriate clauses of the Specification(s).

The results are shown in the RECORD OF PROVING TESTS and by the oscillograms sealed and attached hereto. The values obtained and the general performance are considered to justify the Short-Circuit Rating assigned by the manufacturer, as stated below.

Breaking-capacity at 3.3 kV. Making-capacity 67 kA. peak at 3.3 kV.

Symmetrical 26.3 kA. Short-time current capacity 26.3 kA.

(Equivalent to 150 MVA.) for 3 seconds.

Asymmetrical 32.8 kA.

Duty B-3'-MB-3'-MB

This certificate applies only to the short-circuit performance of apparatus made to the same specification and having the same essential details as the apparatus tested.

The documents under seal and forming part of this Certificate are:

Record of Proving Tests: Sheet Nos. 1 to 13

Oscillograms Nos. 19685 : 19687-9 : 19691-3 : 19697-9 : 19701-3 : 19705-15 : 19719-20

Photographs Nos. TP.3628 to TP.3632

Drawings Nos. A1.054 : A1.052 : A1.109

Manager
Crompton Parkinson Ltd.—
Short-Circuit Testing Station

ASTA Observer
The Association of Short-Circuit Testing Authorities

B. Wheeler Member of Council

G. C. Stebbing Secretary

Date 8th January 1960

The conditions under which this Certificate may be reproduced are governed by Clause 16 of ASTA Publication No. 3—"Conditions for Test Work."

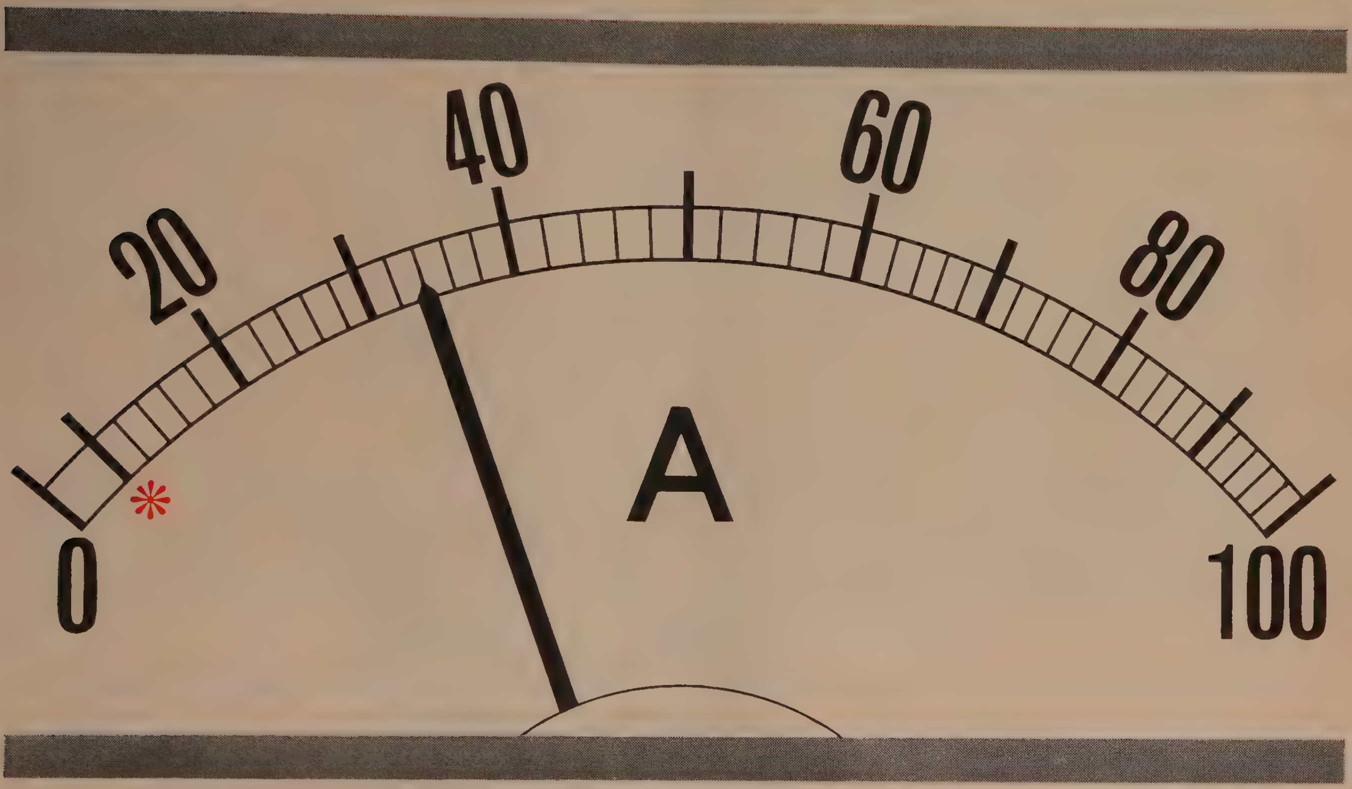
3.3 kV. 150 MVA

The newly designed Type "AH" Switchgear Unit is air insulated and embodies an Air Break Circuit Breaker which has been certified for a Rating of 150 MVA at 3.3 KV in accordance with A.S.T.A. Requirements 16 and 18.

WHIPP & BOURNE LTD.

CASTLETON - ROCHDALE - LANCASHIRE - ENGLAND

Clearly down to 10%*

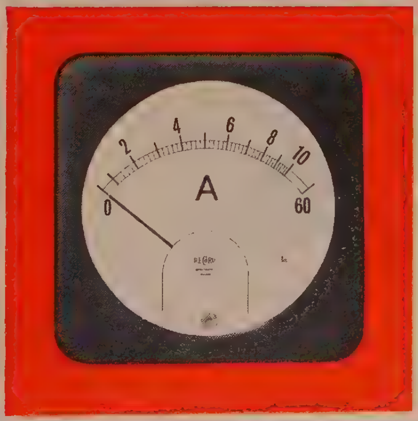


RECORD

MOVING IRON AMMETERS AND VOLTMETERS

This is the scale of a Record Moving Iron Ammeter — not Moving Coil as you might have thought. Note the linearity and ease of reading—clearly down to 10%

Other notable features have not been omitted from this new design, i.e. high torque, low consumption, low frequency and temperature errors, long scale, contemporary design. *Send for full details.*



THE RECORD ELECTRICAL CO. LTD.

"Cirscale Works", Broadheath, Altrincham, Cheshire

Offices at: Belfast, Birmingham, Bristol, Dublin, Glasgow, Leeds, London

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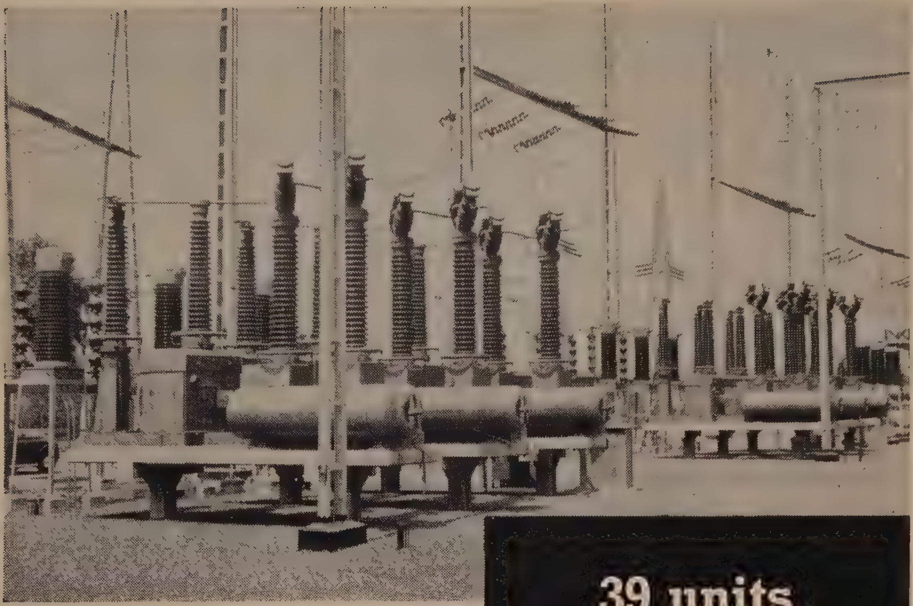

39 units in the Netherlands

Centrale Hemweg
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150-kV 7500 MVA
TYPE-OB30

AIR-BLAST CIRCUIT-BREAKERS

Reyrolle

A. Reyrolle & Co. Ltd - Hebburn - County Durham - England

Famous Midgets

Club for Midgets

In 1713, on the 21st of December (the shortest day) the 'Short Club' was founded in London. Membership was restricted to men under 5 feet and some members were considerably shorter. Meetings were held in the Little Piazza and the main dish at the banquets was invariably shrimps.

After a hectic but appropriately short career, the club was closed down by a riot involving the six-foot members of the rival 'Tall Club'.

Varley
REGD. TRADE MARK

small electric motors

S.C.9 Motor with Rectangular Gearbox.

The motor features a one-piece moulded bobbin and a silver steel shaft. Mounting Brackets are die-cast with 2BA studs in line with bearing bracket for ease of location. Bearings are sintered, with additional felt oil reservoirs for long life, and a ball end-thrust bearing is fitted as standard.

The gearbox has machine-cut gears, the first intermediate being non-metallic for quiet running.

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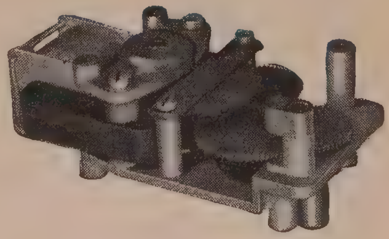
Applications:

Vending Machines; Rotary Spits; Timing Sequences etc.



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Cambridge Row, Burrage Road, Woolwich, S.E.18
Tel: Woolwich 1422 (Five lines) Telegrams: Olipel, London, S.E.18

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Leaflet L601/D "Wardle Floodlight Projectors" available by return of post.

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OLD TRAFFORD, MANCHESTER, 16. *Telephone TRAfford Park 1801 (3 lines)*
London Office: 34 Victoria Street, S.W.1. Telephone: ABBey 4072 and 1356

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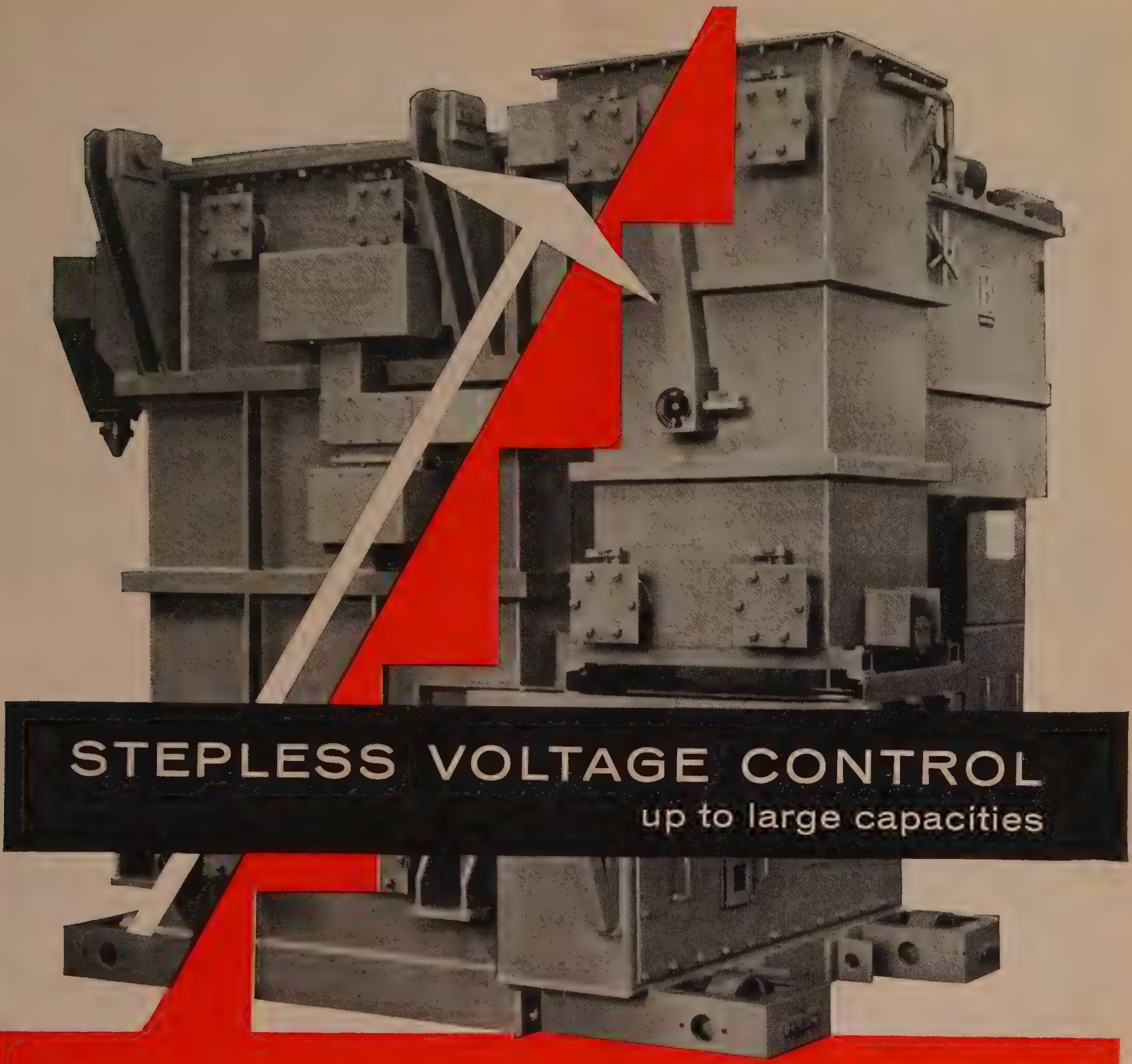

STEPLESS VOLTAGE CONTROL

up to large capacities

Brentford Regulators give:—

- ✱ No wave-form distortion
- ✱ Continuous and very close control
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And they are robust and completely reliable.

These are some of the reasons why so many Brentford Regulators are in service - often under difficult operating conditions; supplying dust precipitators, sea-borne rectifiers, and equipment controlling atomic reactors. They are specified wherever requirements are stringent and reliability is paramount.

In conjunction with our Interstep tap-changing system we make these regulators in sizes up to 5 MVA, and can provide stepless voltage control on transformers up to 33 kV working.

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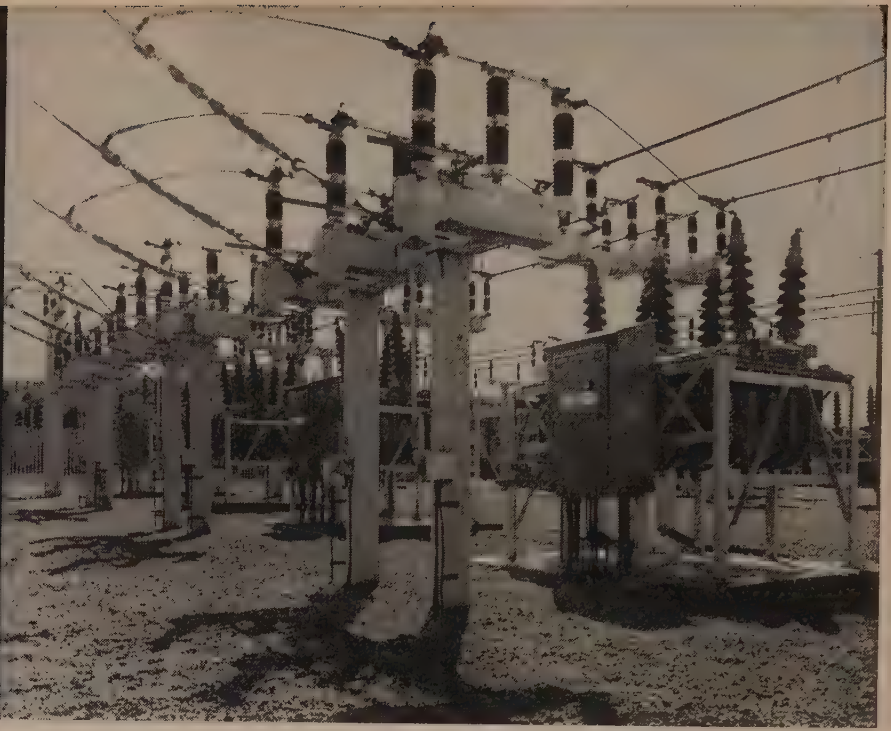
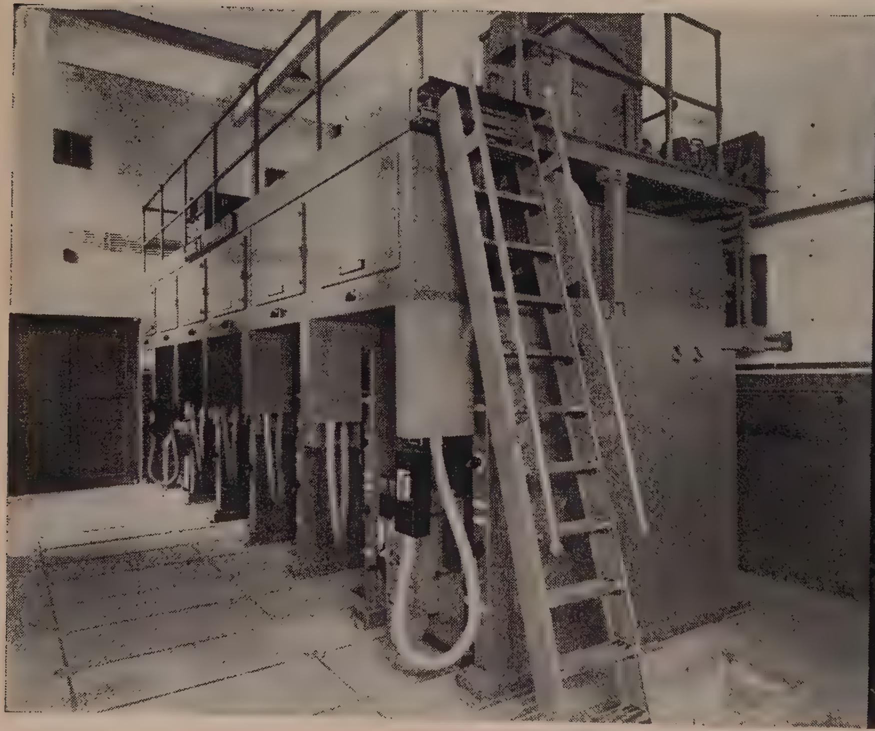
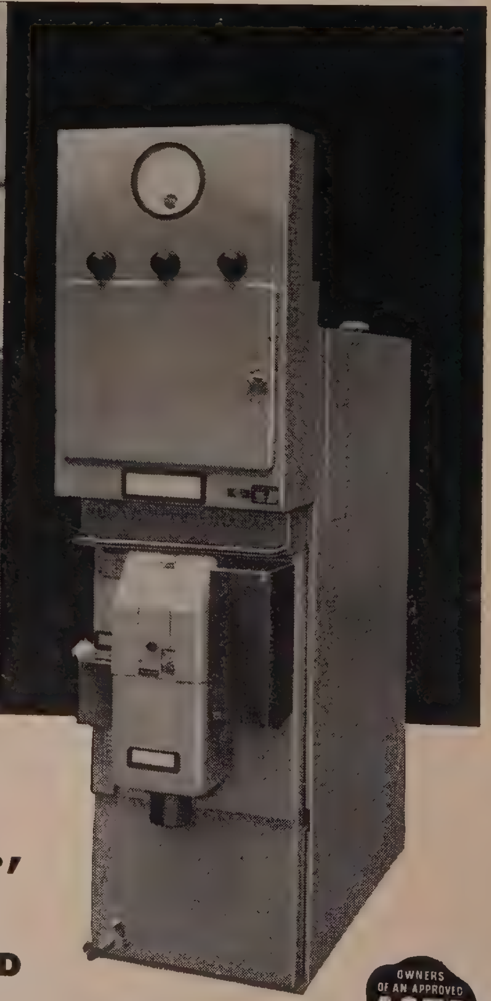


. . . up to and including 66kV





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FMmP PREPAYMENT METER

For optional or single coin use

The Ferranti FMmP Prepayment Meter is now available for operation with:-

- ⓐ Shillings only, or
- ⓑ Two-shilling pieces only, or
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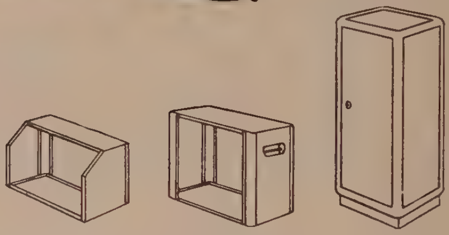
INSTRUMENT & EQUIPMENT HOUSINGS
AT ECONOMICAL COSTS

Instrument cabinets and equipment racks in formed steel sections are Ritherdon's speciality. Made-to-measure for housing communications, control and instrument equipment, these cabinets are all constructed on a 'Standard' system whatever the specified shape or size. Units of basic but flexible design (some examples are illustrated) can be constructed to meet your particular specifications at a price comparable with batch production costs. Ritherdon's method of construction saves design time and avoids the long delays and high costs of housing non-standard equipment.



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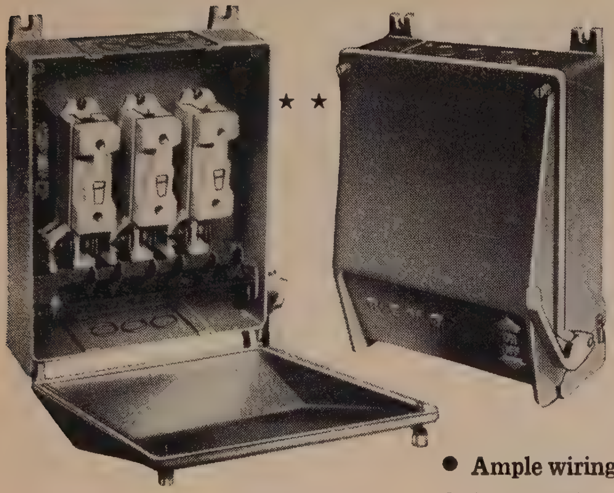


MAGNA

Ironclad Switch Fuses

This range is suitable for *continuous duty at current ratings (from 15 to 100 amperes)*. The cases are weatherproof cast-iron construction, robust yet light in weight.

- **Ample wiring space**
- **Removable switch bar**
- **Rigid but light cast-iron box and lid**
- **Sealing chambers interchange with removable end plates**
- **Gasket in lid for weather and dustproofing**
- **Rewirable or H.R.C. fuse carriers interchangeable**
- **Modern styling**
- **Easy to install**

SAFEWAY

Distribution Boards

A comprehensive range of pressed-steel cased distribution boards, light in weight yet robust in construction. They are rustproofed and grey stove-enamelled finish. Galvanized finish can be supplied.

- **Ample wiring space**
- **Easy installation facilities**
- **Choice of rewirable or H.R.C. cartridge fuse carriers**
- **All 'live' parts effectively shielded**
- **Earth terminal provided**
- **Lid provided with reversible hinging**

Write for further details of **REVO SILVERTIP, MAGNA** and **SAFEWAY** ranges to: **Industrial Division, Revo Electric Co. Ltd., Tipton, Staffs.**

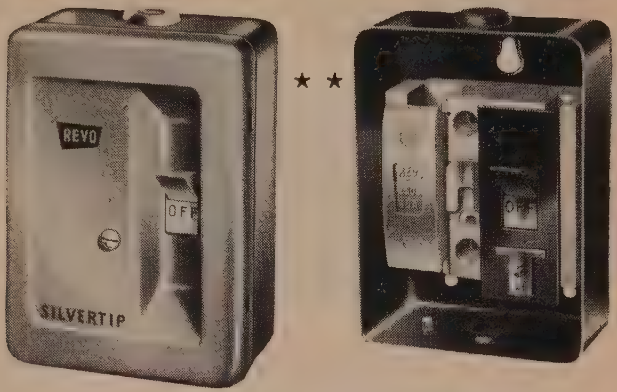
GEAR FOR TODAY'S POWER CONTROL!

SILVERTIP

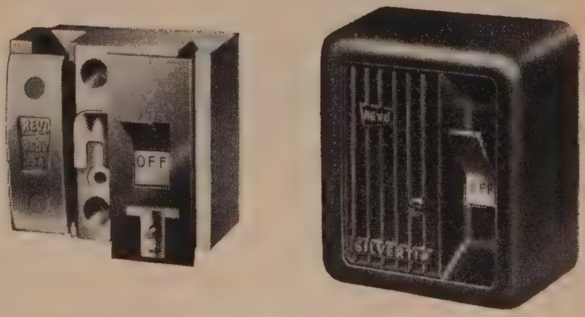
Switchfuses and Splitters

The 'Silvertip' range of switchfuses and splitters has been designed especially for Single Pole and Neutral A.C. Circuits. Each type consists of a Double Pole Slow Break Switch, Single Pole Fusing and Neutral Block. They are housed in either INSULATED or PRESSED-STEEL cases. The 'Silvertip' range covers ratings from 15 to 60 amperes.

- **Ample wiring space**
- **Simple connecting facilities**
- **Switch interlocked with lid**
- **All 'live' parts effectively shielded**
- **Rewirable or cartridge fuse types available**
- **Visual 'ON' and 'OFF' indication**



METAL-CASED TYPE



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SWITCH AND FUSE GEAR

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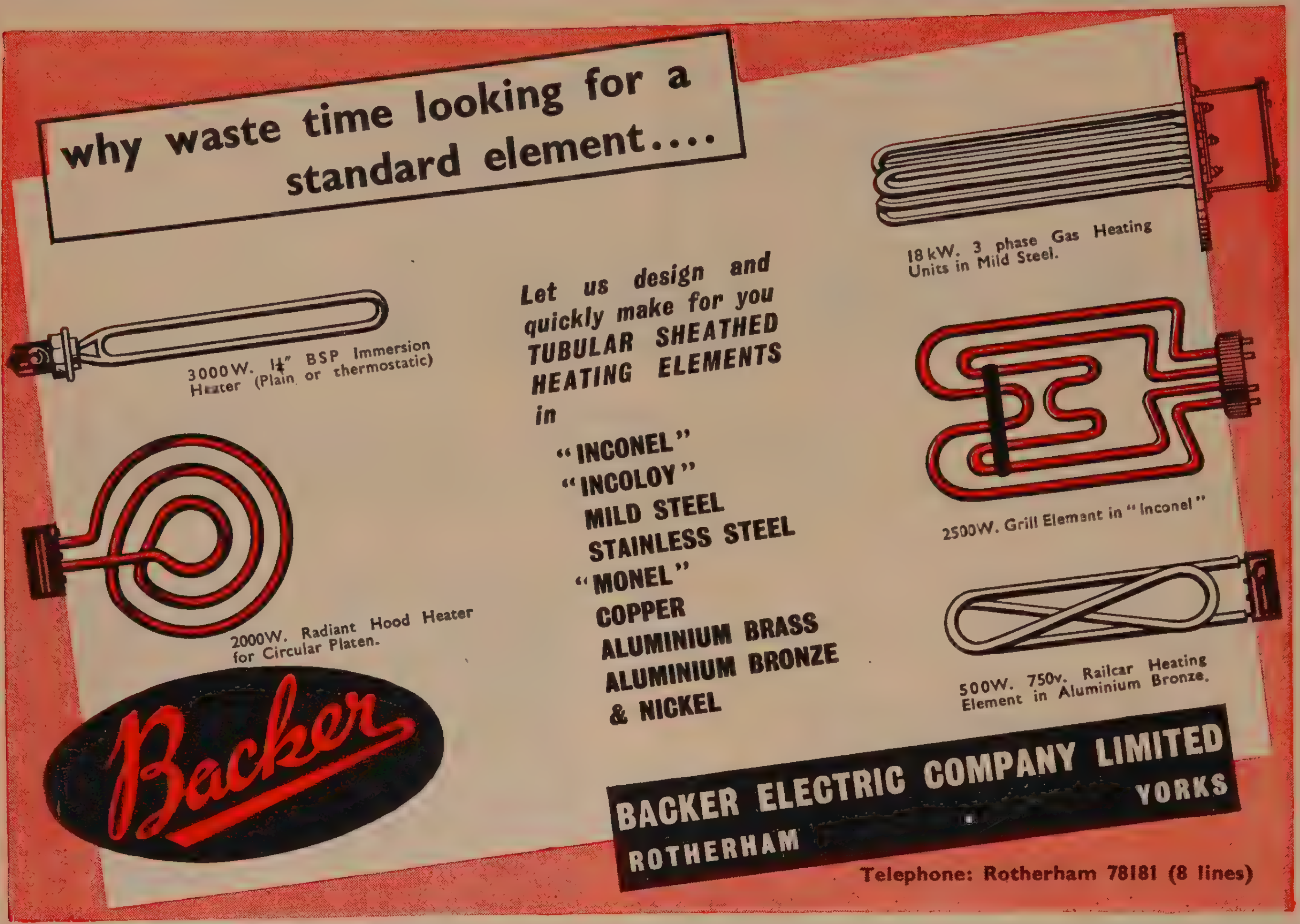

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2000W. Radiant Hood Heater for Circular Platen.

Let us design and quickly make for you TUBULAR SHEATHED HEATING ELEMENTS in

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18 kW. 3 phase Gas Heating Units in Mild Steel.

2500W. Grill Element in "Inconel"

500W. 750v. Railcar Heating Element in Aluminium Bronze.

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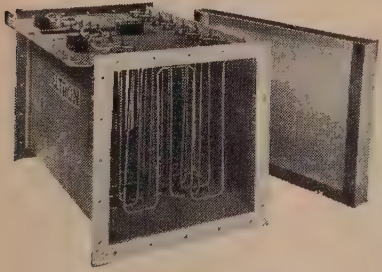

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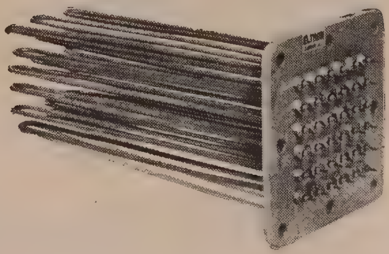

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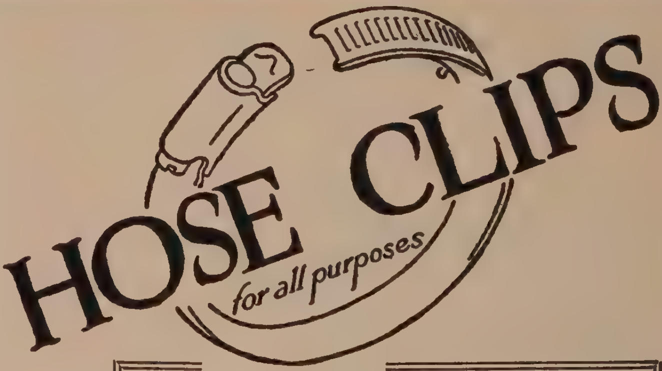

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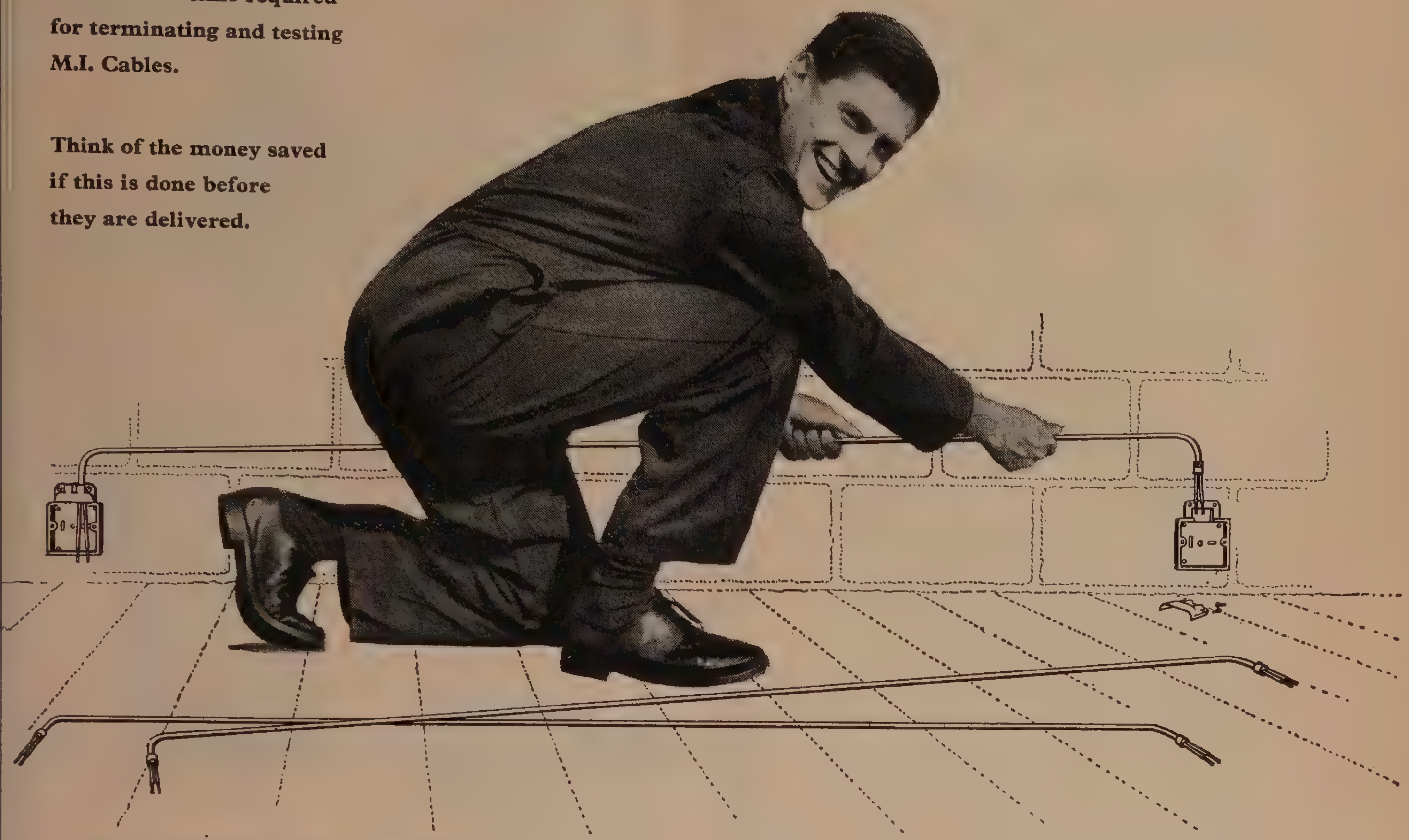
How to save up to 30% on wiring costs

Think of the time required for terminating and testing M.I. Cables.

Think of the money saved if this is done before they are delivered.



BICC BRINGS THE FACTORY TO THE WIREMAN

Wiring units consist of M.I. cables assembled in the factory. Cables are cut to the customer's specified length, sealed — and if required fitted with glands or other accessories.

After comprehensive testing the units, which can be colour or code identified as required, are dispatched in suitable containers.

On receipt they need only be fixed into position and connected up—just like T.R.S.

Wiring units are ideal for the repetition wiring of offices, housing estates and blocks of flats.

They can also be used to advantage in the wiring of machine tools, petrol pumps etc. Remember—M.I. cable wiring units with an oversheathing of P.V.C. offer complete protection against corrosion.

Here are Further Advantages–

There is no wastage: only the exact lengths required are supplied.

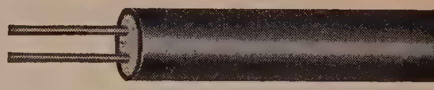
No special M.I. tools are needed.

Any wireman can install them, even without previous M.I. experience.

All units are pre-tested TWICE before leaving the factory.

The time saved leads to drastically reduced installation costs: UP TO 30%.

Any size of M.I. cable can be provided in wiring unit form and, because of factory mass production facilities, they can be produced at a very low cost providing that sufficient quantities of identical units are ordered.



M.I. CABLES

consist of fully annealed copper conductors in a compressed mineral insulant within a solid-drawn copper sheath. They are designed for both power and lighting applications, and have exceptional strength and electrical stability.

M.I. cables are fireproof, waterproof, mechanically tough, non-ageing and easily installed.

you can have this economy with **BICC** FACTORY-MADE **M.I. WIRING UNITS**

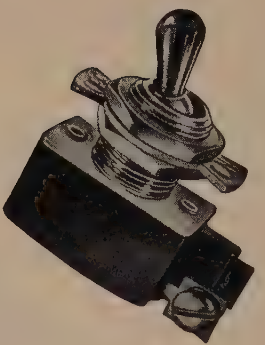
Further information and details of delivery from your nearest BICC Branch Office

BRITISH INSULATED CALLENDER'S CABLES LIMITED 21 BLOOMSBURY STREET LONDON WC1

Arcolectric

Switches

Neon Signal Lamps



G.600

S.L.160, S.L.162 and S.L.163

New miniature low cost Neon Signal Lamps.

½″ hole fixing. All completely waterproof.

The S.L.163 has small front of panel projection.

C.S.200: 15-AMP Rotary Cooker Switch.

Double pole three “ heat ” and “ off. ”

S.L.50: Neon Signal Lamp with snap-in fixing.

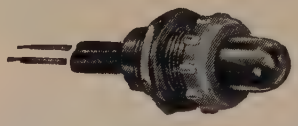
M.30: 10-AMP Toggle Switch.

A.55: Refrigerator Door Switch.

S.254: A.C. only 10-amp Toggle Switch, double pole.

S.250: A single pole version of the S.254.

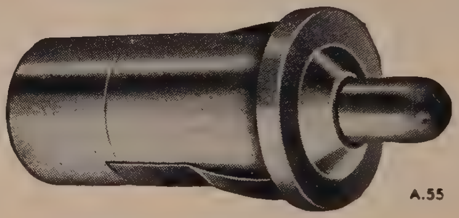
G.600: 3-AMP Toggle Switch.



S.L.160

S.L.162

S.L.50



A.55

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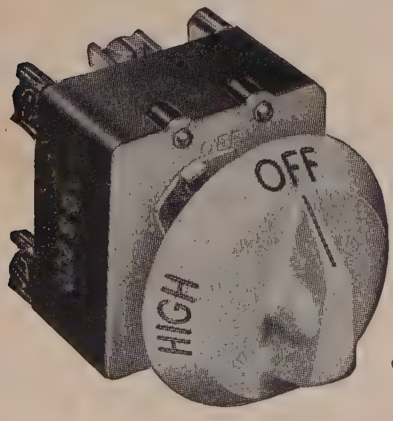
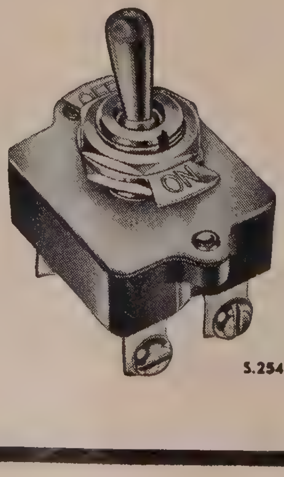
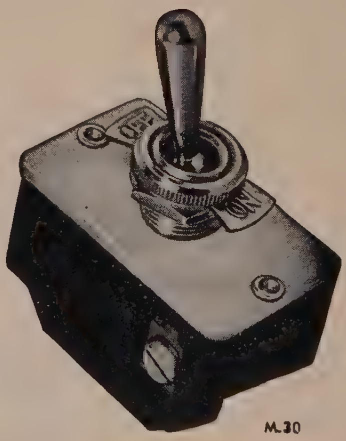


C.S.200



S.254



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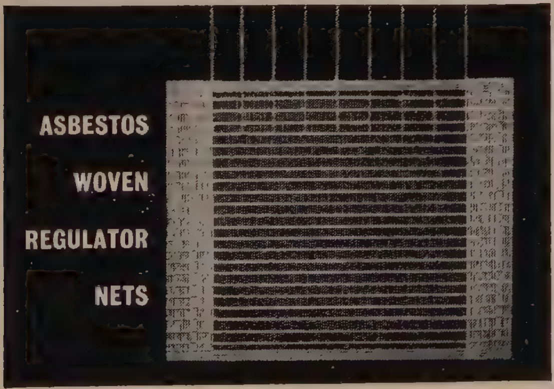

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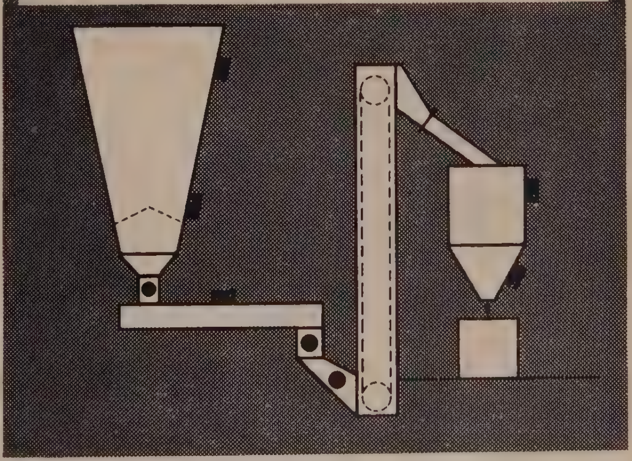

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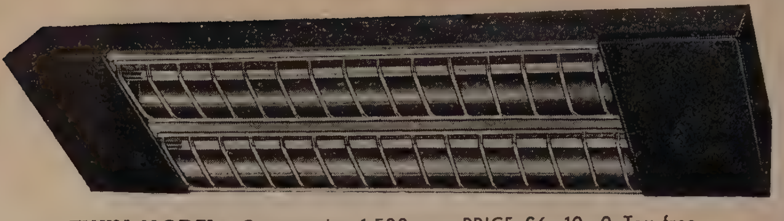

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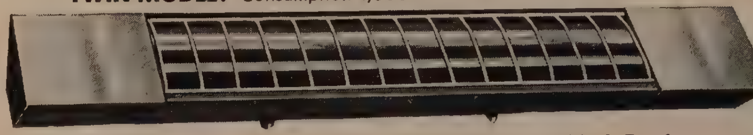

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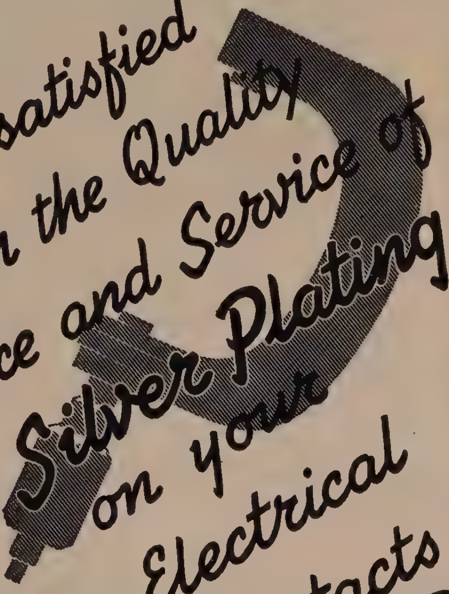

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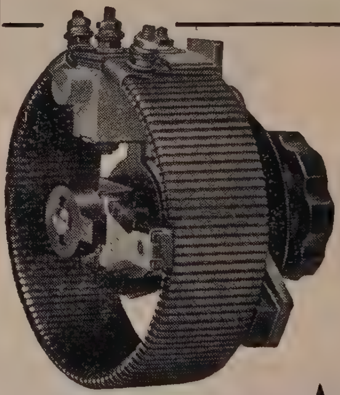

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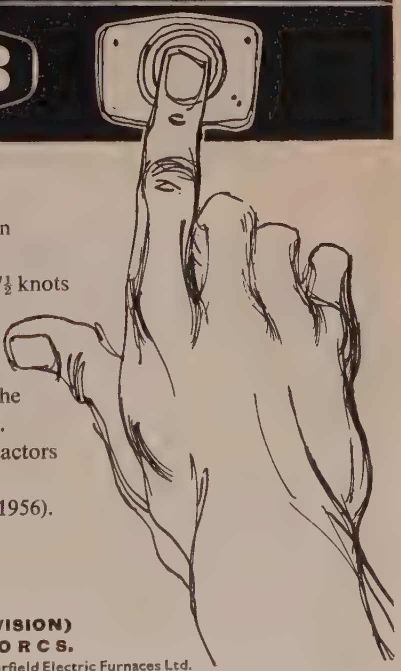

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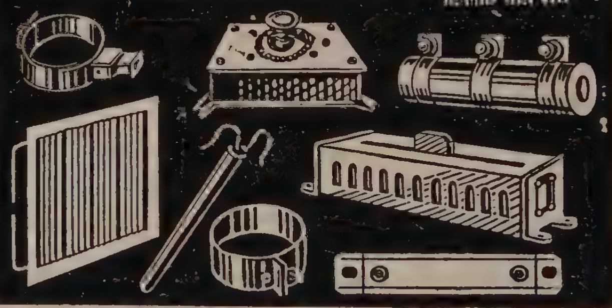

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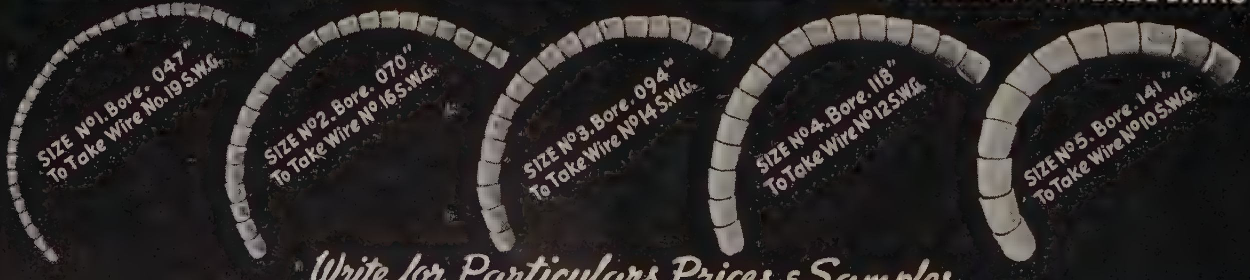
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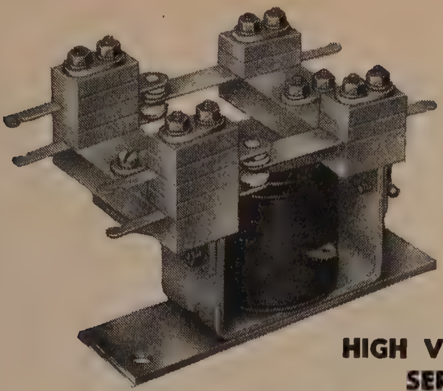

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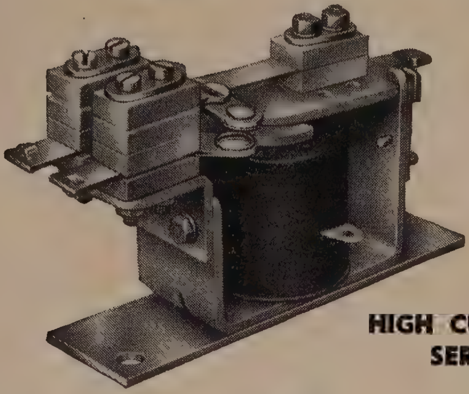

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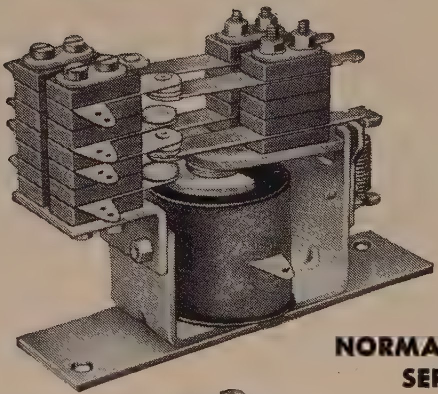

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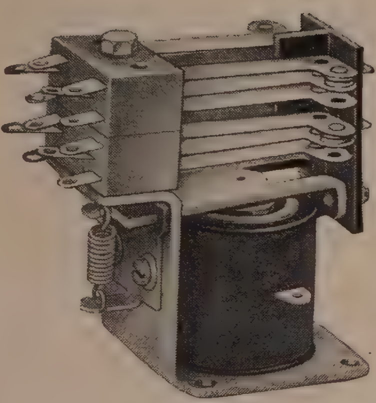

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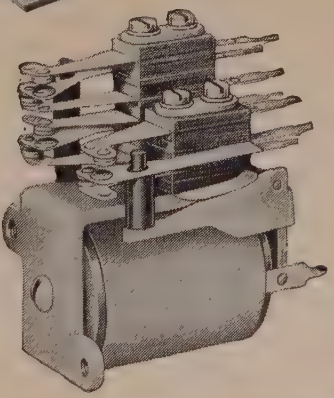

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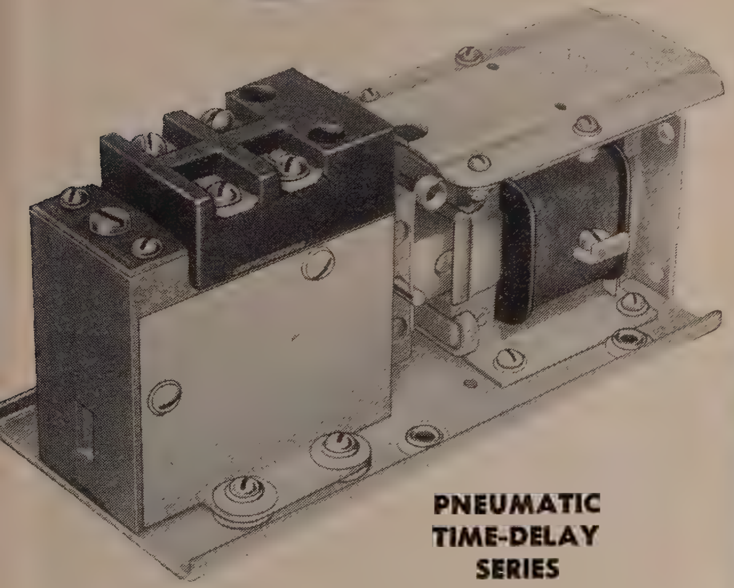

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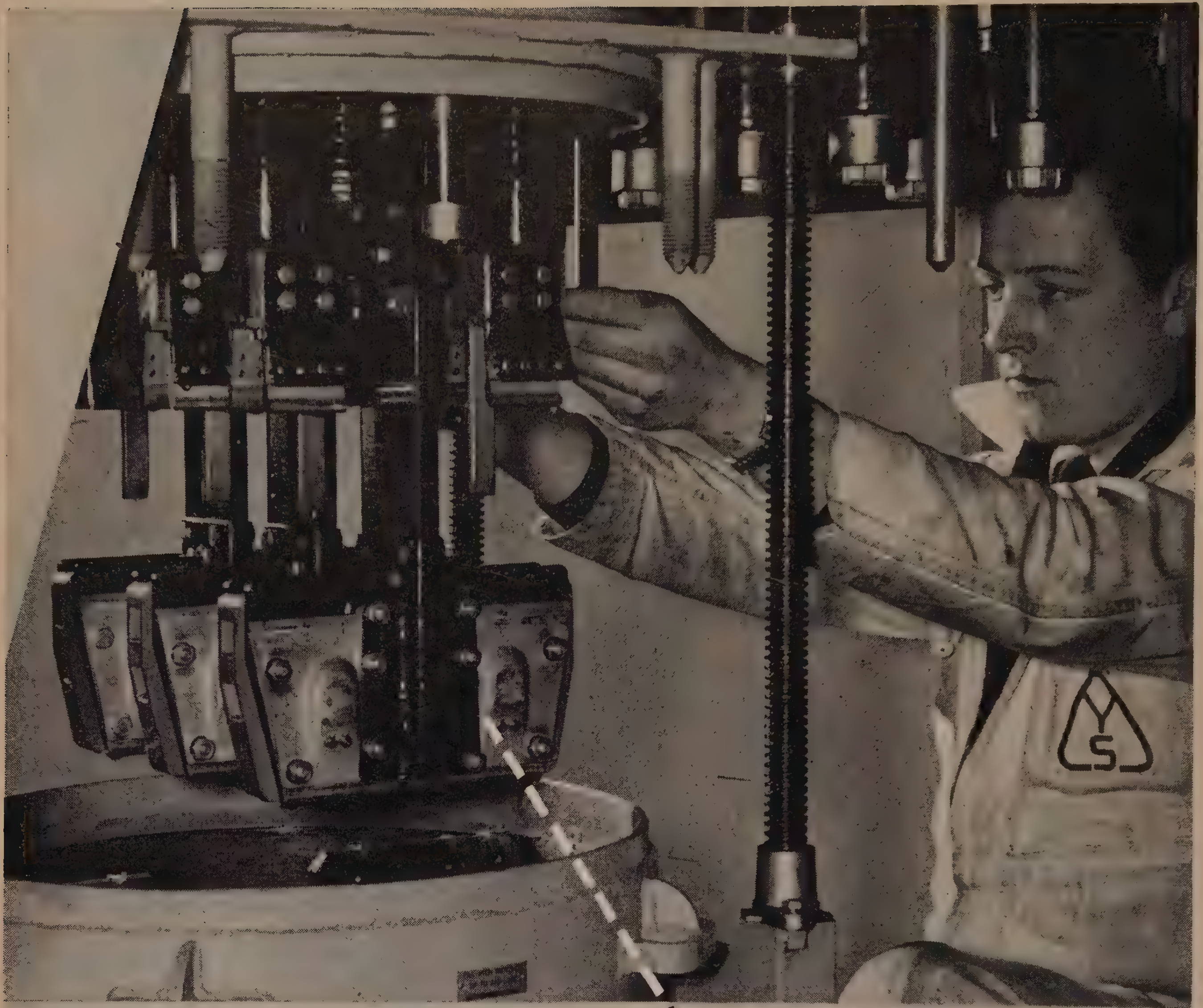

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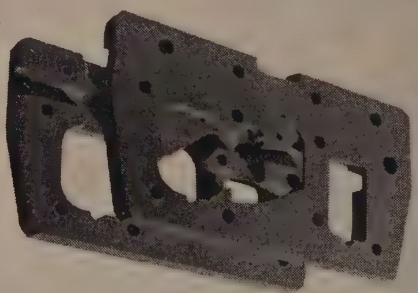

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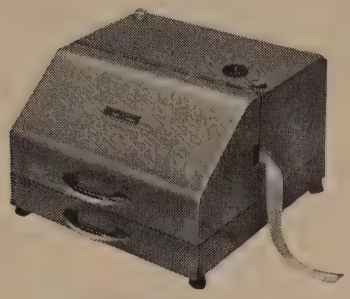

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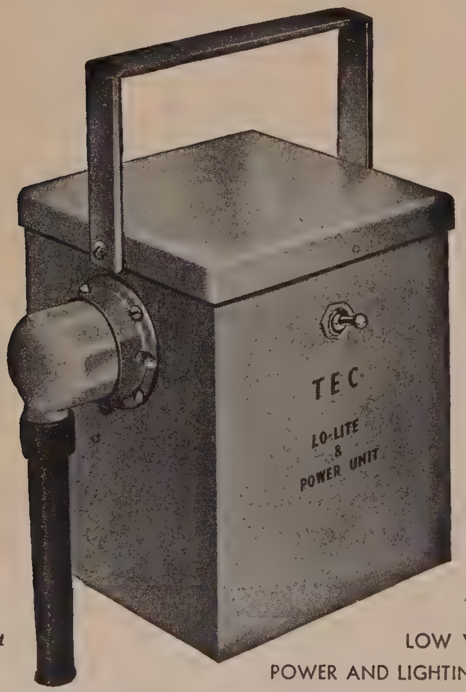

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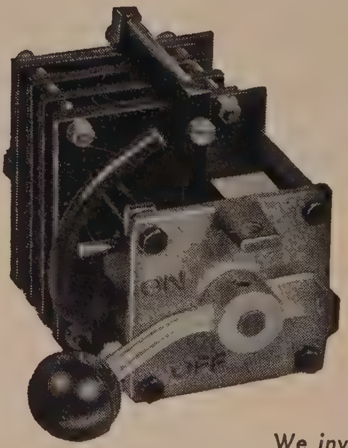

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Tensile strength (p.s.i.)	8,500
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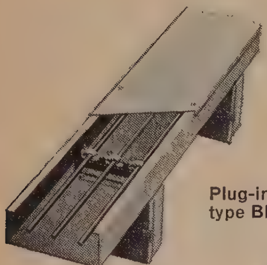
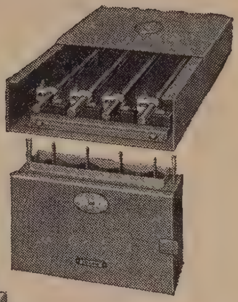
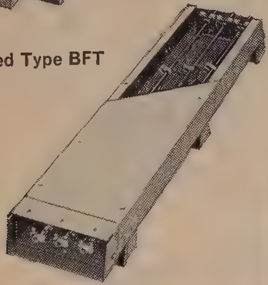


Plug-in type BPN

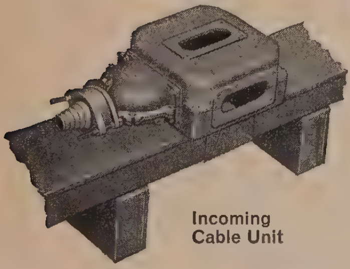


Plug-in Fuse Box and Socket Assembly

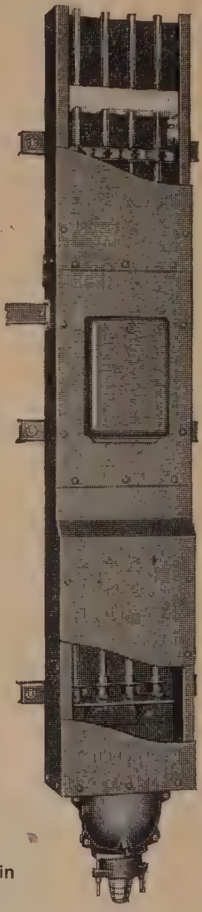


Fixed Type BFT

Fixed Fuse Box



Incoming Cable Unit



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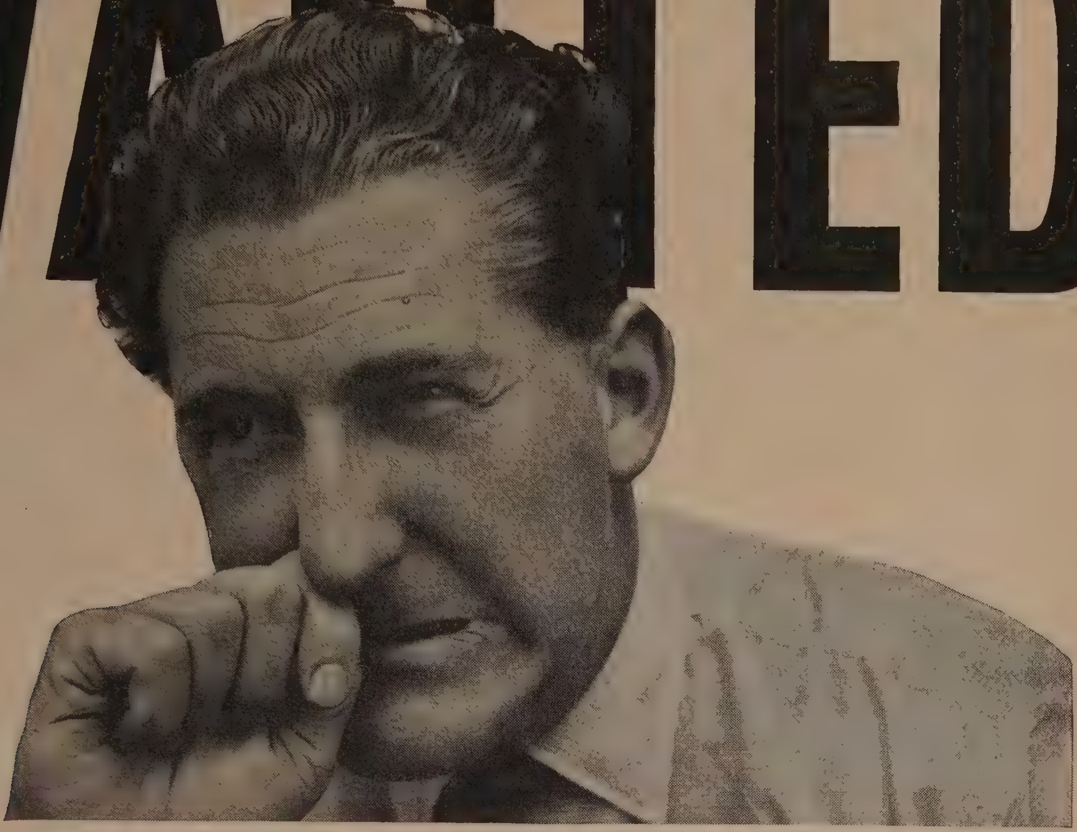

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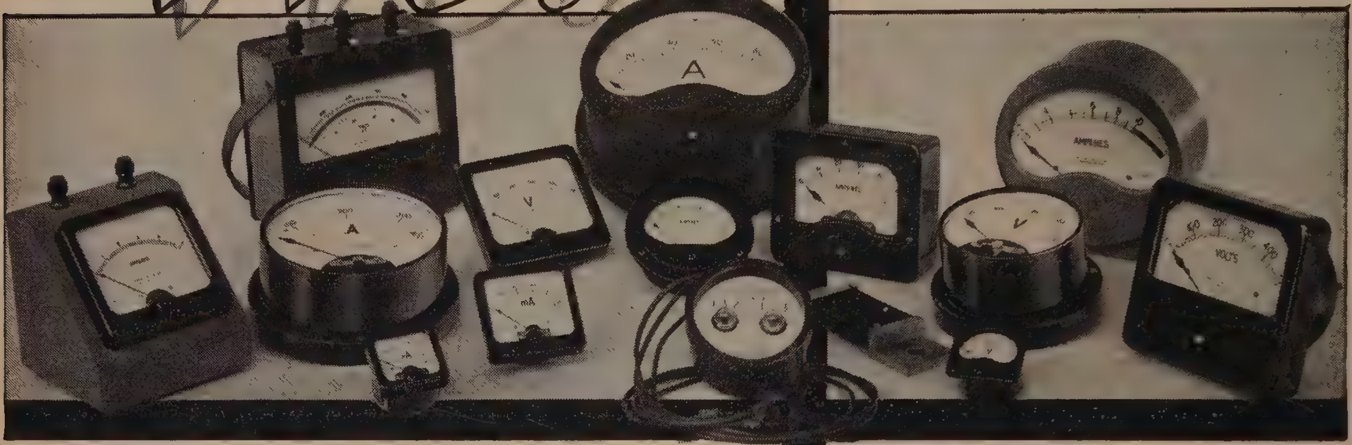

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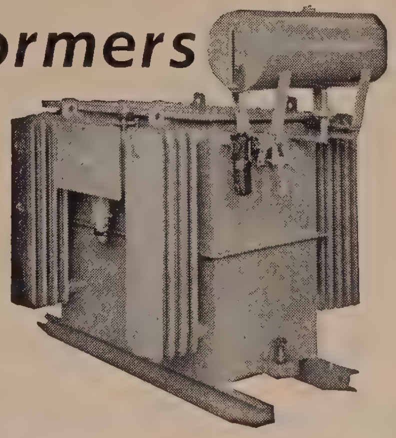

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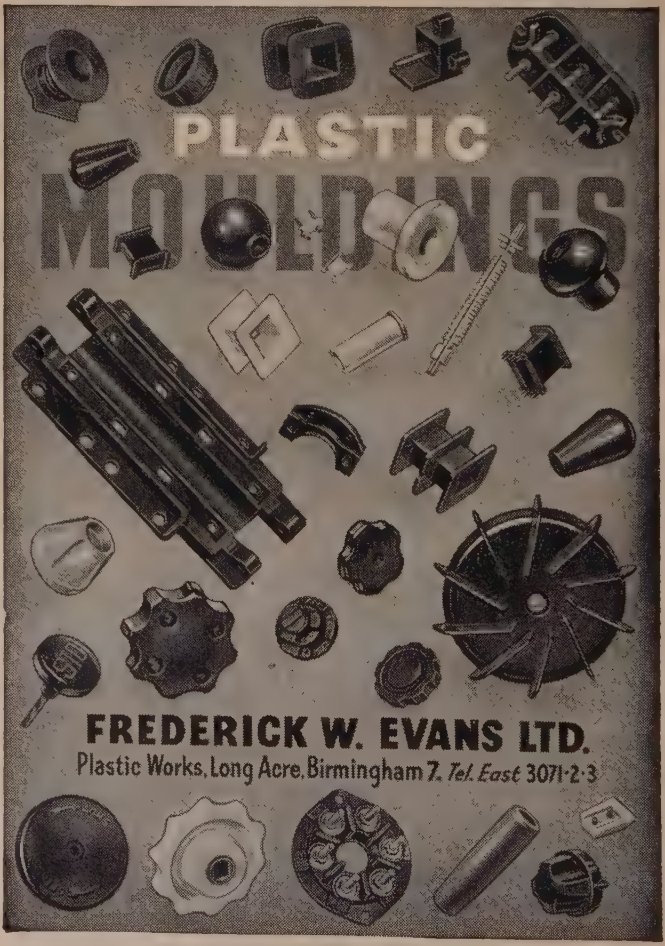

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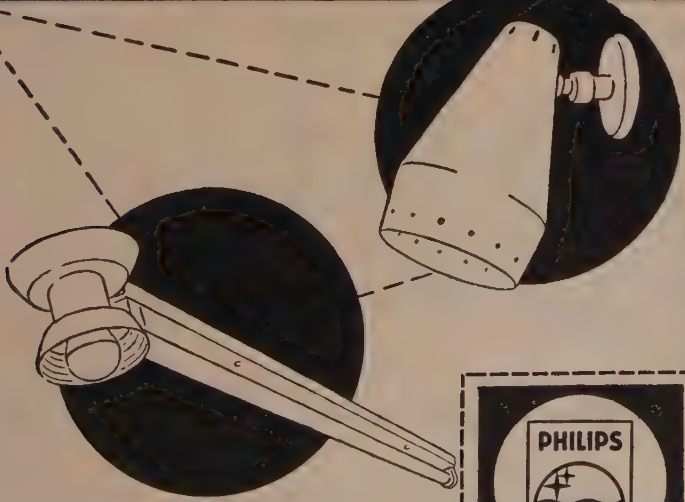

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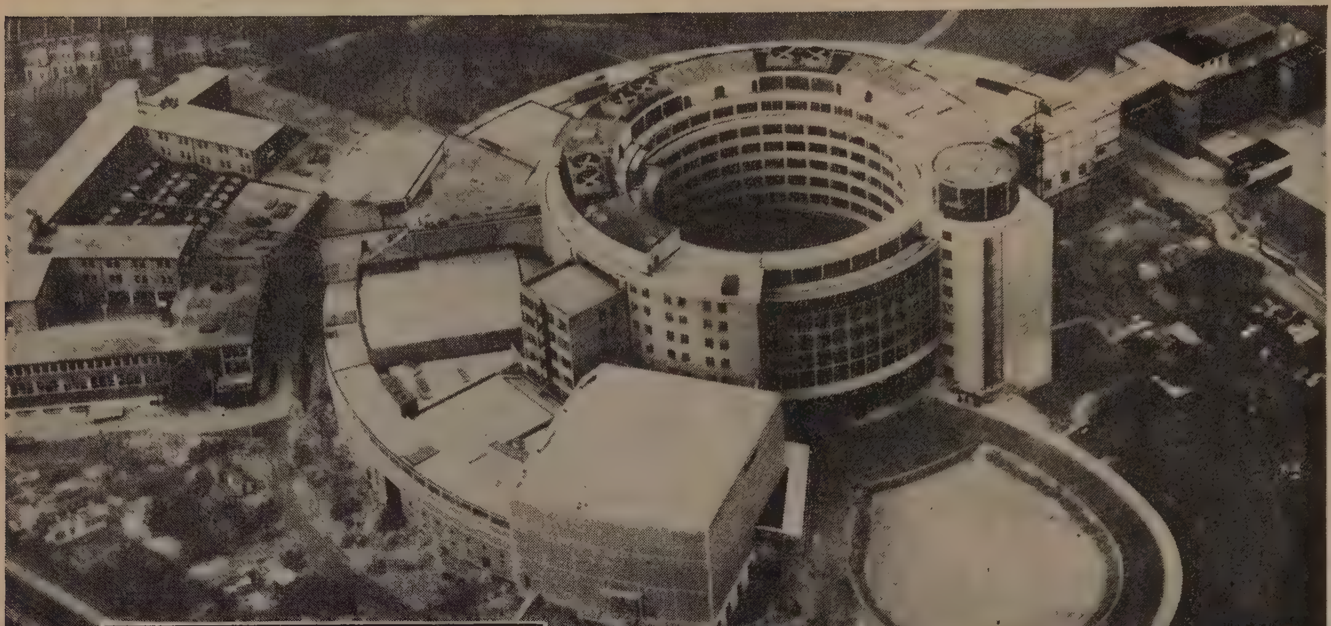

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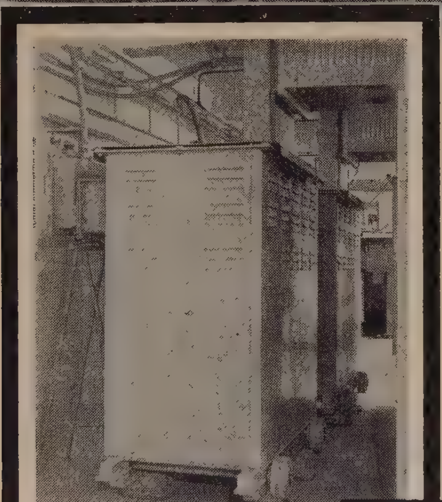

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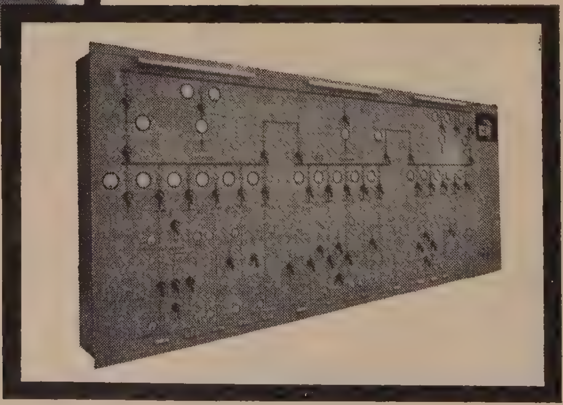

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ELECTRICAL REVIEW

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National Transport in 1959	**79**	The annual report of the British Transport Commission for 1959 shows that a loss of £84 million on British Railways was transferred to special account under the provision for deficit financing during the first phase of modernisation which the Government has approved

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Domestic Electrical Equipment Supplement: Electric Fires— Facing Back Cover

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ELECTRICAL REVIEW

8 July 1960 Vol. 167 No. 2 Established 1872

Progress in Electrification

SOME improvement in the fortunes of British Railways is recorded in the 1959 report of the British Transport Commission, which is reviewed on page 79 of this issue, although there was again a heavy deficit on working—£42 million, increased to £84 million after meeting interest and other central charges. Freight revenue was lower because of the further decrease in coal and coke traffic although the volume of general merchandise moved upwards. A continued fall in coal traffic must be expected as the electrification of industry and the home proceeds. In earlier days this would have been largely compensated for by the carriage of coal to power stations. Now the policy is to site these stations near coalfields and transport power by e.h.v. lines to other areas instead of moving the coal. Competition from road and sea transport has also had its effects, presumably being cheaper.

As " dieselisation " and electrification of the railways go ahead the railways' own coal requirements fall; last year the electricity consumption went up by 24 million kWh (3·3 per cent) to 33,230 million and fuel oil consumption by 17·4 million gallons (70·3 per cent) to 42·1 million. At the same time coal consumption fell by 1·1 million tons (10·3 per cent) to 9·6 million.

Dieselisation has, from the start, been regarded as a " halfway house " to electrification and consequently there should be a growing use of electricity, while ultimately oil consumption should reach a peak and gradually fall. The Commission reports good and on-schedule progress in its electrification schemes. It is seen from the accounts that capital expenditure by British Railways during last year included £2·7 million for electric locomotives and £12·5 million for electric multiple-unit vehicles, representing additions of about 69 and 30 per cent respectively to the gross book values at 1st January, 1959; but the increase in diesel stock was considerably greater.

In view of the inevitable disorganisation entailed in the work of electrifying the railways it may be said that as it has been embarked upon " 'twere well it were done quickly." Indeed it is the Commission's desire, as expressed in a White Paper last year, that modernisation (which covers electrification) should be pressed forward more rapidly than hitherto planned. At present, as mentioned in the report, there are two inquiries " of political origin " into the Commission's situation now taking place. Also at the present time the Government is determined to restrict capital expenditure and there have been ominous references to the " public sector."

It is our view that the ultimate salvation of the railways lies in electrical operation. If the 1931 report of the Weir Committee had been acted upon the railways would not have fallen into their present unfortunate situation. Any attempt to slow down modernisation will worsen matters by deferring for too long the hope that the system will eventually operate without subsidy.

THE NUCLEAR FUTURE

In view of the recent revision of the nuclear power programme there may be a tendency to think that activity in this field will soon lapse into a state of quiescence and, as a result, this country will lose its lead over the rest of the world. The experience gained in building Calder Hall, Chapelcross, Dounreay and the graphite-moderated, gas-cooled natural uranium civil power stations has provided a foundation for future developments which could not be obtained in any other way. Although it may be suggested that the civil stations at present being built are obsolescent, they will provide 3,000 MW of power at a reasonably economic rate. Admittedly the original conception that nuclear power would be absolutely essential by 1965 was incorrect, but the decision to go ahead was not wrong in the light of the conditions at the time.

Nuclear power certainly will become a vital necessity to this country, but not until about the mid-'seventies, and development work must continue at a vigorous rate. The fact that it is doing so is illustrated by the progress being made with the prototype advanced gas cooled reactor (A.G.R.) at Windscale and the experimental high temperature gas cooled reactor (H.T.G.C.) at Winfrith Heath. Furthermore, it has just been announced that a zero-energy reactor (ZEBRA) is to be built by the Atomic Energy Authority at Winfrith Heath as part of a programme of fast power reactor development and in this respect will be complementary to the work being carried out at Dounreay. ZEBRA will be used to provide information for the design of a prototype—the next step in the development of the fast reactor. One should not be too critical of the British programme to date—after all the United States' first nuclear plant has only just reached full output (180 MW), and this is the largest they have.

MACHINE TOOL DRIVES AND CONTROLS

The International Machine Tool Exhibition which closes today at Olympia, London, must surely be one of the most comprehensive specialised engineering exhibitions ever held in this country. Machine tools of all shapes, sizes and complexity have been on view, providing the visitor with a first-class illustration of the way in which the humble lathe has been sophisticated and had its range of functions extended, largely through the agency of electric drives and controls.

Domestic Equipment Supplements

To meet the wishes of many readers we are producing our future domestic appliance schedules in the form of separate detachable supplements. The first of these—electric fires—will be found at the back of this issue. Our next supplement will deal with low temperature heaters

The electrical engineer has made a major contribution towards the development of machine tools generally and without electrical controls automation of the machine shop would not be possible. It is a pity, however, that there is not more evidence of really whole-hearted collaboration between the tool designer and the electrical and electronic engineer. An understanding of each other's problems would lead to the production of more efficient and clear-cut designs instead of arrangements that give the impression that some existing machine has been modified. From conversations which we had with a number of overseas visitors, however, it is evident that British machine tools are still regarded as being among the finest in the world.

NO " CLASS DISTINCTION "

Conferences organised by societies or associations in the electrical engineering industry cover a wide range of activities and include members of various ages and social standing. For complete success such a conference must represent a cross-section of all members. The younger ones will produce ideas while their elders pass on the benefit of their experience. Unfortunately, many conferences are dominated by a disproportionate number of older men and business politics and social grading lead to the formation of groups within groups. All this tends to frighten the younger engineers away: the very people who would benefit most from the conference.

The I.E.E. Summer Meeting cannot, however, be classed as a conference as no technical papers or discussions take place. It is mainly a social event and, therefore, a friendly atmosphere without distinctions is even more necessary and was achieved. This year's meeting was held in Glasgow last week and we can report that it was a great success. The majority of delegates enjoyed themselves, perhaps somewhat more than usual, especially the Englishmen who were " abroad." A brief report of the event is published elsewhere in this issue, but it is, of course, impossible to give more than an outline of social events and thirty visits which were packed into five days and nights.

LIQUID METAL COOLED REACTORS

By **H. CHILTON**, B.Sc., A.M.I.Chem.E., A.M.I.Mar.E.*

The main object in nuclear power plant design is to extract as much heat as possible at the highest practicable temperature from the reactor core. Gases are not very effective coolants, even at high pressures, and this limits the rate of heat extraction. Water is a good coolant but the temperature level is limited by boiling even at high pressure. The temperature at which organic liquid coolants can be used is limited by thermal decomposition. Liquid metals are good coolants and generally have high boiling temperatures, even at atmospheric pressure, and appear to impose less restriction on the design of power reactors than do more conventional coolants. The use of various metals in experimental or prototype reactors is described in this article, with some of the engineering considerations involved

EXPERIENCE of liquid metals as high-temperature coolants is still very limited despite intensive research and development programmes, and this remains the main obstacle to large-scale commercial application. Data on liquid metals and alloys which may be of interest in reactor design is given in Table 1. Liquid water at 300°C and carbon dioxide gas at 150 p.s.i.g. are also quoted for comparison. Interest is not confined to metals which are liquid at room temperature, since circuit preheating is well established as a feasible proposition.

Relative to non-metal coolants, the thermal conductivity of liquid metals is spectacularly high. Temperature differences between solid surfaces and liquid metals are usually quite small, even when the heat flow between them is very high. This heat transfer is a considerable advantage, but it may cause severe thermal stress and thermal shock in solid metal components. In the fuel elements, conduction of heat through the solid fuel and can without excessive centre temperature and thermal stress is one of the two factors which may limit the heat rating of a liquid metal cooled reactor. The second possible limitation is in the transport of heat from the reactor.

Heat output=Mass flow rate × Specific heat × Temperature rise.

There are limits to the rate at which a liquid metal can be circulated through a core of given size and so specific heat may control the potential heat output. Liquid metals, except lithium, do not have very high specific heat, and the heavy metals are particularly unsatisfactory in this respect. To offset this disadvantage, the temperature rise in a liquid metal cooled reactor circuit is usually quite high, at some 100 to 200°C.

The outstanding difficulties in liquid metal technology arise from interactions between the liquid metals and the solid metal structural and containing members. The mechanisms of attack are not fully understood, but there seem to be two main effects. If the solid metal forms a more stable oxide than the liquid metal, it will oxidise at the expense of any dissolved oxygen in the liquid metal.

TABLE I.—COOLANT PROPERTIES

Coolant	Melting Point	Boiling Point	Cost (approx.)	Thermal Neutron Absorption Cross-Section	At 400°C Density	Thermal Conductivity	Specific Heat	Solubility of Iron
	°C	°C	£/ft^3	cm^2/cm^3	gm/cm^3	cal/sec °C cm	cal/gm °C	p.p.m.
Carbon dioxide	—	—	0·01	10^{-6}	0·009*	0·00014*	0·265*	
Water	0	100	—	0·0155	0·707†	0·0013†	1·33†	
Sodium Na	98	883	3	0·0112	0·859	0·17	0·306	0·0046
Potassium K	64	760	40	0·0228	0·754	0·096	0·183	
Lithium Li	186	1,317	120	2·98	0·49	0·09	1·0	
22% Na, 78% K	−11	784	32	0·0223	0·755	0·066	0·252	
Mercury Hg	−39	357	750	14·6	12·8	0·031	0·033	0·075
Bismuth Bi	271	1,477	500	0·0009	9·91	0·037	0·035	2·04
Lead Pb	327	1,717	40	0·0052	10·5	0·038	0·037	0·25
44·5% Pb, 55·5% Bi	125	1,670	300	0·0027	10·19	0·022	0·035	
97·5% Pb, 2·5% Mg	250	—	40	0·0051	10·0	0·04	0·04	

* At 150 lb/in^2 g. † At 300°C and about 1,250 lb/in^2.

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TABLE 2.—SODIUM COOLED REACTOR DATA

Reactor		1 Calder Hall	2 Dounreay	3 E.B.R.II	4 E.F.F.B.R.	5 S.R.E.	6 S.G.R. C.P.P.D.
Country		U.K.	U.K.	U.S.A.	U.S.A.	U.S.A.	U.S.A.
Coolant		CO_2	Sodium	Sodium	Sodium	Sodium	Sodium
Type		Thermal	Fast	Fast	Fast	Thermal	Thermal
Completion date		1956	1959	1960	1961	1957	1962
Electrical output	MW	35	—	20	90	6	75
Thermal output	MW	143·7	60	62·5	300	20	254
Core diameter	ft	31	1·75	1·6	2·54	6	14
Core height	ft	21	1·75	1·19	2·6	6	14
Mean core rating	kW/litre	0·321	450	890	840	4·16	4·18
Fuel		U	U	U	U	U	UO_2
Fuel enrichment	% U235	0·7	40	49	26·6	2·8	3·5
Fuel loading	tonnes	130	—	0·363	1·82	2·57	22·4
Max. fuel rating	watts/cm³	50	—	4,500	3,700	300	300
Mean rating of U235	kW/gm	0·158	—	0·314	0·553	0·32	0·325
Fuel rod diameter	in	1·15	see text	0·144	0·15	0·75	0·5
Max. fuel temperature	°C	500	—	650	700	650	2,200
Coolant inlet temperature	°C	140	200	370	290	260	320
Coolant outlet temperature	°C	336	350	482	425	516	507
Coolant temperature rise	°C	196	150	112	135	256	187

Reactive metals such as beryllium, zirconium, titanium, molybdenum, niobium and vanadium form oxides more stable than sodium oxide. The rate of attack depends on temperature and on the proportion of oxygen in the liquid metal which must be kept very low, less than 5 p.p.m. Reactions involving carbon or nitrogen in place of oxygen may also be relevant.

If the container metal is appreciably soluble in liquid metal a different form of attack termed "mass transfer" is encountered and this is the main mechanism in the attack of iron and steel. The solubility of iron in liquid metal increases with temperature so there is a tendency for it to dissolve in the hotter parts of the circuit and precipitate in the cooler regions. The rate of mass transfer of iron tends to increase with its solubility in the liquid metal. Some solubility figures at 400°C are quoted in Table 1. Unlike most corrosion processes, dissolution in liquid metal cannot result directly in solid products which may form a protective coating. Some success has been achieved in inhibiting mass transfer attack by mercury on steel by dissolving a small proportion of titanium in the mercury. It is believed that the titanium combines with nitrogen liberated by the dissolution of steel in the hot region, to form a protective coat of titanium nitride. A similar technique shows promise of inhibiting mass transfer of iron in liquid bismuth.

The thermal neutron absorption cross-sections listed in Table 1 are a measure of the absorption of thermal neutrons in unit volume of the coolant. Such absorption is purely parasitic. It is highly undesirable and must be paid for in higher enrichment of the fuel. In this respect most liquid metals are markedly inferior to gas. This disadvantage does not apply to fast reactors, since few

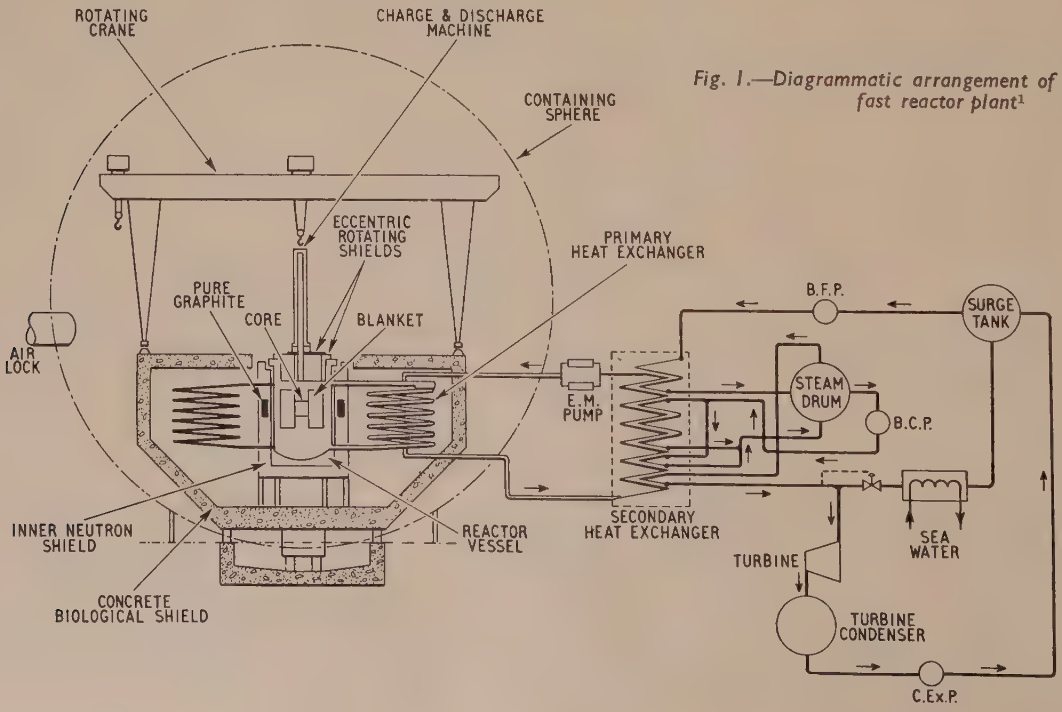


Fig. 1.—Diagrammatic arrangement of the Dounreay fast reactor plant[1]

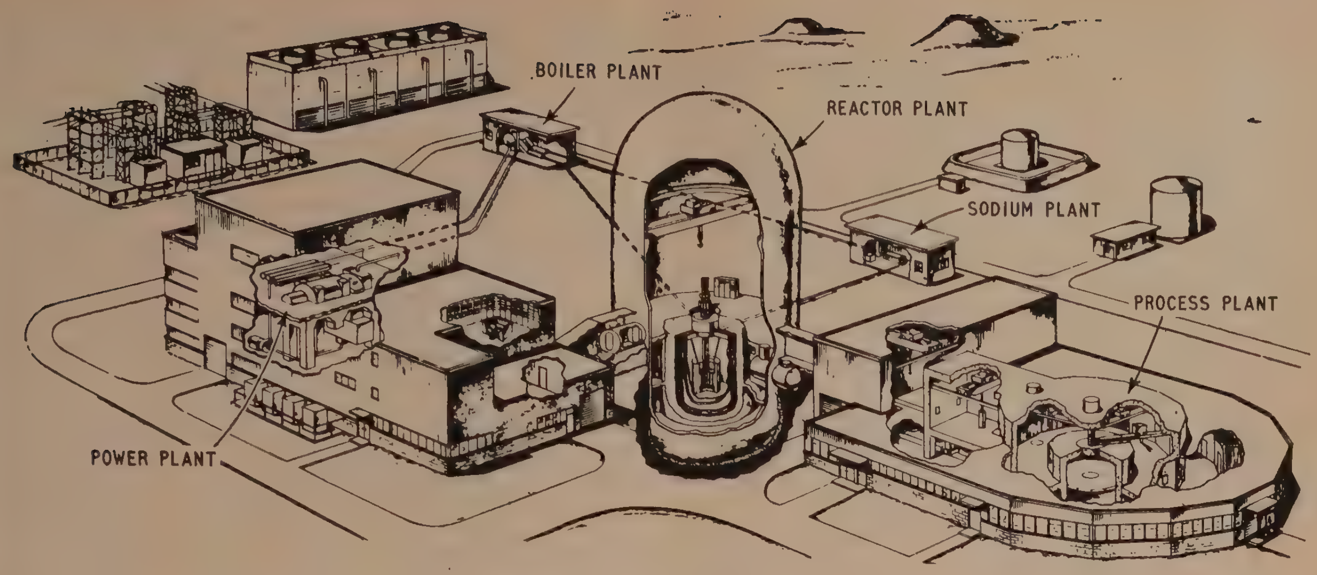


Fig. 2.—Perspective view of E.B.R.II fast reactor plant[2]

elements have large absorption cross-sections for fast neutrons.

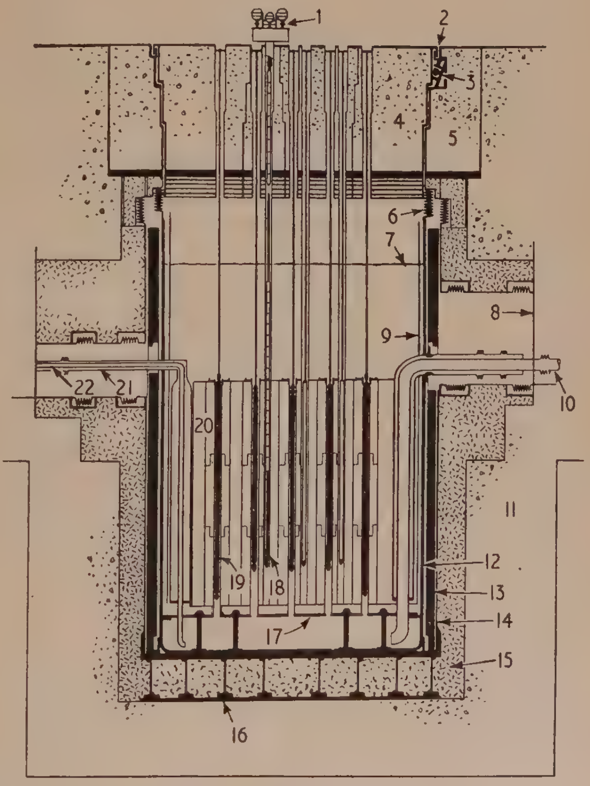
Alkali Metals—Sodium, Potassium and Lithium

Sodium has received far more attention than any other potential liquid metal reactor coolant and particulars of some sodium-cooled reactors are given in Table 2, with corresponding data on the gas-cooled Calder Hall reactor for comparison. Figs. 1, 2 and 3 show respectively a diagrammatic view of the British Dounreay fast reactor, a cut-away perspective view of the American E.B.R.II (experimental breeder reactor) fast reactor power plant and an elevation of the American S.R.E. (sodium reactor experiment) thermal reactor. All these reactors are, or will be, cooled with liquid sodium.

Stainless steel appears to provide reliable long-term containment for liquid sodium at temperatures up to at least 500°C, provided oxygen levels are kept down, and encouraging results are reported with low alloy chromium-molybdenum ferritic steels which are being developed to provide a cheaper and more convenient container material. Sodium is cheap and plentiful, and has excellent thermal properties. Static sodium is compatible with uranium. Its absorption cross-section for thermal neutrons, however, is high and it becomes highly radioactive. It reacts violently with water, appreciably with steam, burns in air and attacks graphite by exfoliating its structure.

In a fast reactor, nuclear considerations require that the concentration of fissile material in the fuel must be high compared with thermal reactors, so the fuel is correspondingly more expensive. It is a prerequisite of an economically acceptable fast reactor that the heat rating of the fuel should be very high. In practice, liquid sodium coolant is virtually unchallenged for this application, and it is closely linked with the future of fast reactors.

This is well illustrated by comparing the American fast reactors E.B.R.II and E.F.F.B.R. (Enrico Fermi fast breeder reactor) in Table 2 with the Calder Hall design. The heat removal rate will be increased by a factor greater than 70 per cm^3 of fuel, and by more than 2,500 per litre of core volume. However, the huge increase in fuel rating is offset by the higher enrichment and so the rating per gram of fissile material is only modestly increased. If account is taken of the cost of separating the fissile material, the cost of fuel per unit heat output is probably rather higher in these fast reactors than in a gas-cooled thermal reactor.



1. Control element drive. 2. Seal. 3. Roller. 4. Rotatable shield. 5. Ring shield. 6. Bellows. 7. Sodium level. 8. Diaphragm. 9. Inner liner. 10. Main sodium inlet line. 11. Biological shield. 12. Core tank. 13. Thermal shield. 14. Outer tank. 15. Thermal insulation. 16. Bearing plate. 17. Grid plate. 18. Control element. 19. Fuel element. 20. Moderator element. 21. Guard pipe. 22. Auxiliary sodium inlet line

Fig. 3.—Sectional elevation of S.R.E. thermal reactor core[3]

There is no reason to anticipate difficulty in removing the heat in the sodium coolant, but an acute problem arises in conducting heat through the solid fuel to the can surface without excessive central fuel temperature or thermal stress. In the American designs this is met by reduction in fuel rod diameter to about 0·15in. The difficulties of core construction can be appreciated from Fig. 4 which is a full-size section of the core lattice in E.B.R.II. Precise relative location of these thin rods must be maintained without undue restriction of the coolant passages and despite volume changes in uranium under neutron irradiation and at high temperature.

Published data on the British fast reactor at Dounreay are less comprehensive, but heat release rates seem to be about half those in the more recent American designs. The fuel elements for Dounreay are hollow ¾in o.d. and ¼in i.d. cylinders. This provides an elegant solution to the problem of providing a robust fuel element with good heat conduction characteristics, but it does tend to expense in fabrication.

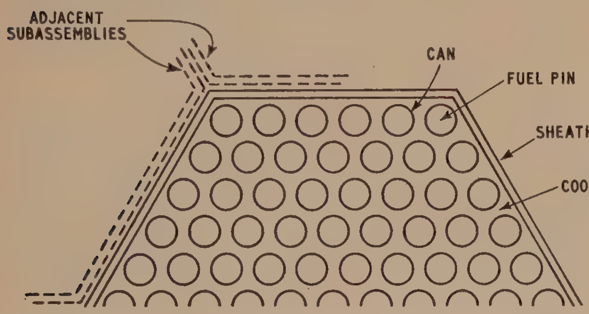


Fig. 4.—A full-size half-section of an E.B.R.II core sub-assembly

A small fast reactor cooled with liquid sodium-potassium alloy was in operation as early as 1951. Although it was capable of generating 250 kW of electrical power its main purpose was experimental. It suffered partial melt down of the core in 1955 during an experiment involving a calculated risk, while testing the second design of core. A third core has recently been installed and the reactor is again operating. The S.I.R. (Submarine Intermediate Reactor) was another early American sodium-cooled reactor partially moderated so that neutron energy was intermediate between fast and thermal. It has been announced that this type has been abandoned for submarine propulsion in favour of the pressurised water type of reactor. Some troubles were experienced in developing the " boiler " in which steam was raised and superheated by hot liquid sodium.

In a thermal reactor the concentration of fissile material is much lower than in a fast reactor and the need for extreme fuel rating is less acute, but the reaction between sodium and potential moderators such as water and graphite must be considered. The thermal neutron absorption cross-section not only increases the required enrichment, it also introduces a potential hazard, since loss of coolant from the core, either by leakage or by expulsion due to boiling of the sodium in the core channels, would increase reactivity. Despite these factors, sodium-cooled, graphite-moderated, thermal reactors have been extensively studied in both Britain and America. Table 2 gives particulars of two American designs, S.R.E. and S.G.R. C.P.P.D. (sodium graphite reactor, Consumers Public Power District of Nebraska). The S.R.E. reactor shown in Fig. 3 has been in operation since 1957.

In the S.R.E. reactor the graphite moderator takes the form of hexagonal graphite prisms, each about 11in across the flats. The centre of each prism in the core region is pierced to form a circular coolant channel. Each graphite column is clad in zirconium sheet 0·035in thick to exclude sodium, and each coolant channel contains a cluster of seven fuel rods, clad in stainless steel 0·010in thick. Moderator columns as well as fuel clusters may be replaced if necessary by the charge-discharge equipment. Operation so far reported has been at low power. Initial difficulties due to thermal shock when the reactor was shut down have been overcome by suitable control of the sodium circulation rate. Some pipes up to 1½in in diameter have choked with sodium oxide and a few small valves have failed, but these too have been remedied. The most serious difficulty so far reported is attack of the zirconium canning. On balance the experience is regarded as encouraging.

The S.G.R. C.P.P.D. reactor will be a scaled-up version of S.R.E. Apart from increased size, the main differences will be that stainless steel instead of zirconium will be used for canning the graphite moderator blocks, and that uranium dioxide will be used instead of metallic uranium fuel to reduce damage to the fuel structure after long irradiation. Both these changes tend to increase the amount of fuel enrichment and outweigh the effect on enrichment of increasing core size. The purpose of E.B.R.II and S.R.E. reactors is to gain knowledge and experience. E.F.F.B.R. and S.G.R. C.P.P.D. are intended to demonstrate the feasibility of power generation under commercial conditions. It is hoped that these projects will provide the knowledge and inspire the confidence on which a large-scale programme of economically attractive sodium cooled power reactors can be based.

Liquid potassium is similar to, but generally less attractive than, liquid sodium. Some sodium-potassium alloys are liquid at room temperature and so they are often used as a substitute for liquid sodium in experimental and development work. Liquid natural lithium has an attractively high specific heat but its thermal neutron absorption cross-section is too high for it to be considered as a coolant for thermal reactors. It is unattractive as a fast reactor coolant because of a relatively high absorption cross-section for fast neutrons. Natural lithium is a mixture of 7·5 per cent Li6, a high cross-section isotope, and 92·5 per cent Li7. It is often pointed out that the separated Li7 isotope, which has a thermal absorption cross-section of only 0·0014 $\mathrm{cm}^2/\mathrm{cm}^3$ would be nearly ideal as a reactor coolant if it were available in large quantity at acceptable cost. This is true with regard to thermal and nuclear considerations but containment might prove difficult. Although lithium is broadly similar to liquid sodium, it is more reactive and more aggressive.

Mercury, Bismuth and Lead

The only liquid metal which has so far found commercial application in electric power generation is mercury. A generating unit operating on the binary mercury vapour-steam cycle was commissioned in 1922. Substantial difficulties in containing mercury were overcome and other similar units were built and successfully operated in America. The development of high pressure, high temperature steam plant now provides a more straightforward route to high efficiency and the binary cycle is obsolete. Mercury was used as coolant in the reactor "Clementine," started up in Los Alamos, America, in 1946. This was the first fast reactor, the first reactor to be cooled with liquid metal and the first reactor to use plutonium fuel. It was purely experimental, with a power output of only 25 kW and it was dismantled in 1953. Because of its relatively low boiling point, high thermal neutron absorption cross-section and high price, mercury is not an attractive coolant for power reactors.

Bismuth has the outstanding advantage of low neutron absorption cross-section. It is compatible with graphite and both uranium and plutonium are appreciably soluble in it. This combination of properties has inspired extensive studies of reactor systems using as fuel a solution of uranium or plutonium in bismuth, and cooled either by liquid bismuth or by circulating the fuel itself through external heat exchangers. Many alternative reactor proposals spring from this concept, some of which are thermal systems which may be capable of breeding as much fissile material as they consume. So far as is known, there is no bismuth cooled reactor system at present in operation. Steel is subject to mass transfer attack in liquid bismuth heat transfer circuits. As previously noted, inhibitors are being developed, but the problems of containment are not completely solved. The cost of bismuth would be an appreciable item in the inventory of a power reactor. Under neutron irradiation bismuth is transmuted to polonium which is an intense alpha-emitter with a half life of 138 days. Polonium is very highly toxic. Bismuth reacts exothermically with the alkali metals to form intermetallic compounds which are solid at normal operating temperatures. If it is the primary coolant a cheaper liquid metal compatible with it is required for secondary or auxiliary liquid metal circuits and lead or its alloys may be useful for this purpose.

Lead is not unattractive as a primary reactor coolant but it is overshadowed by bismuth with superior nuclear properties and sodium which has better thermal properties and is easier to contain.

Containment and Associated Considerations

One of the main advantages of liquid metal reactor coolants is that they may operate at low pressure and it might be supposed that they would consequently be easier and cheaper to contain than high pressure gas or water. Ultimately this should be so, but in the present stage of experience the "factor of ignorance" is such that elaborate measures are required to guarantee complete containment under all conditions. Peculiarities of liquid metals such as their high radioactivity after neutron irradiation, the need for extreme purity, and the highly reactive nature of the alkali metals aggravate containment problems so that unusually high standards of workmanship, inspection and materials may always be required, despite the low operating pressure.

Primary containment is in a welded steel circuit. If non-welded closures are necessary they should be confined to the gas space over the liquid metal if possible, and must be accessible for maintenance. The main reactor vessel, and preferably all pipes and accessories exposed to the primary coolant, will be closely surrounded by a second, liquid-tight shell so that if the primary containment leaks or fractures, the liquid metal will be contained in the surrounding vessel at a level well above the top of the reactor core. This second vessel will be surrounded by the concrete biological shield which may be steel lined on the inside to form in effect a third containing vessel. At some stage in a series of accidents the liquid metal might contact atmospheric air and a fire could be expected, particularly if the coolant were sodium. Provision must therefore be made to contain the radioactive sodium and the products of its combustion which would be highly toxic. For this purpose, a large steel shell may completely surround the reactor and all pipes and components containing liquid metal which has been exposed to neutron irradiation. This is the purpose of the Dounreay sphere seen in Fig. 1. Equivalent precautions in the E.B.R.II plant are indicated in Fig. 2.

The liquid metal has a free liquid-gas surface in the upper part of the reactor vessel to provide room for expansion. Inert gases such as argon or helium are suitable and nitrogen may be acceptable in some cases. The interspace between the reactor vessel and its surrounding shell may be filled with nitrogen to reduce the fire hazard if the liquid metal leaks.

Provision must also be made for removing any oxygen which may find its way into the liquid metal. In a liquid sodium circuit contained entirely in stainless steel, a "cold trap" will probably be adequate. This consists essentially of a vessel cooled to near the freezing point of sodium, through which a side stream of sodium flows. Since the solubility of oxygen, as sodium oxide, in liquid sodium falls as temperature is reduced, sodium oxide is precipitated. Oxygen may be reduced to about 10 to 20 p.p.m. in this way. If the circuit includes metals which form oxides more stable than sodium oxide some form of oxygen "getter" is required. Metals such as magnesium or barium may be dissolved in sodium for this purpose, but this introduces the problem of recovering their oxides. Alternatively titanium or zirconium which are insoluble in sodium may be used in a "hot trap." They are disposed as thin sheets at high temperature, in a side stream from the main sodium circuit.

At some stage in a liquid metal cooled reactor, heat will be transferred from liquid metal to water or steam at high pressure. Quite a large surface area will be required and the thickness of tube wall will be less than that in other parts of the containment. Pressure difference is large and appreciable thermal stresses are likely. It is here that the integrity of the liquid metal containment is most vulnerable. Current practice provides one system of tubes containing the high pressure steam-water circuit, and a separate tube system containing the liquid metal. At Dounreay, parallel water and liquid sodium pipes are connected by heavy copper bridges to provide a path for heat conduction. In American designs the tubes may be concentric. The interspace between systems is monitored so that leakage from either is promptly detected.

As indicated in Fig. 1, the steam generating heat exchangers are fed with liquid metal by pumped secondary circuits. Each secondary circuit receives heat from the reactor coolant in a simple liquid metal to liquid metal heat exchanger and discharges heat in the double-walled steam generating exchangers already described. Thus high pressure water and steam would not have access to the primary coolant and reactor vessel and core even if they did manage to penetrate to one of the secondary circuits. Since the secondary circuits are not exposed to neutron irradiation, they do not become radioactive and so they do not require shielding, nor need they be confined within the containment sphere or its equivalent.

Glands are another region of weakness in liquid metal circuits. Several types are being developed and a range of specially designed components such as valves and centrifugal pumps have now satisfactorily completed many thousands of hours of operation in liquid sodium test rigs. Such components are included in American reactor designs. An alternative approach adopted in the Dounreay design avoids components requiring glands. Circulation is by electromagnetic pumps and the number of independent secondary circuits is large enough to make circuit valves non-essential.

There are of course many other problems to be faced in designing liquid metal cooling circuits for reactors. Important examples are providing continuity of circulation and maintaining an effective heat sink under all circumstances, but such problems are common to all reactor circuits.

Future Prospects

Although some test rigs with sodium coolant seem to have enjoyed uneventful operation, published data normally suggest a fairly high incidence of troubles during early stages. However, these do not seem to have been of a fundamental nature and were often amenable to obvious remedies. There is reason to suppose that as experience accumulates it will be possible to produce consistently reliable liquid sodium circuits without demanding major advances beyond established standards of high-class workmanship and materials. Liquid potassium and sodium alloys are very similar to sodium, but liquid lithium is more difficult to contain. The technical success ultimately achieved with the binary cycle encourages the view that reliable containment of liquid bismuth, lead and their alloys can be achieved, since the problems are similar to those presented by mercury.

If adequate standards of reliability can be proved, there is no doubt that the low pressure and small size of liquid metal cooled reactors can lead to substantial reductions in the cost of nuclear power plant. This is particularly true of the fast reactor which also offers the prospect of low fuel cost. The development of reliable liquid sodium reactors may well be near success. If so, it will still be necessary to demonstrate that consistent long-term reliability has in fact been achieved. Inevitably this will take a long time.

Provided that there are no severe setbacks in the current sodium cooled reactor projects, commercial exploitation of the fast reactor is expected to start in the 1970's and power generation costs of about 0·4d/kWh are forecast. When large-scale application is realised experience will accumulate very quickly and developments leading to further cost reduction should be rapid during the following years.

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FUEL CELLS

AT the annual conference of the Institute of Sewage Purification at Scarborough recently a paper on "Fuel Cells and their Potentialities for Power Generation from Sludge Digestion Gas" was presented by Dr. H. H. Chambers, the director of research of the Sondes Place Research Institute. He said that the work at the Institute at Dorking had as its primary objectives the development of general-purpose cells to run on any industrial fuel gas or vaporised liquid hydrocarbon. The Sondes Place cells consumed a great variety of fuels, were unaffected by catalyst poisons and, once the operating temperatures of 500 to 700°C were reached, were self-maintaining because of heat developed on load. In one form the electrolyte was a molten mixture of sodium and lithium carbonates held in the pores of sintered magnesium oxide diaphragms. The porous electrodes were of a mixture of zinc oxide and metallic silver.

Cell performance was similar with hydrogen, carbon monoxide and higher hydrocarbons such as kerosene. Methane, because of its stability, was the most difficult hydrocarbon to oxidise, but it was the main constituent of sludge digestion gas and natural gas and there was a big incentive to use it in fuel cells. Recent work had shown that it could be done by increased activation of the electrodes. A high output per unit area of electrode was desirable. With the present method of construction the ultimate limit of performance appeared to be about 10 kW per cubic foot of battery.

Zero Energy Reactor

IT is announced that the United Kingdom Atomic Energy Authority is to build a zero energy fast reactor at Winfrith Heath, Dorset. The reactor, named "ZEBRA" (Zero Energy Breeder Reactor Assembly), has been designed to permit the study of the neutron physics of a wide variety of fuel assemblies containing uranium and plutonium. The assemblies under study will be built up by loading fuel elements into a steel matrix (approximately a 10ft cube). The fuel elements contain both fuel plates and plates of neutron-absorbing material. The last mentioned will be used to simulate the nuclear properties of the coolant and structure material which would be required in a power reactor. ZEBRA will be operated at room temperature and the heat output from the nuclear reactions in the core will be kept very low so that no cooling system is necessary. It is planned to commission the reactor during 1962. The work will complement that carried out at Dounreay.

DEVELOPMENT PLANS IN NIGERIA

RAPID ADVANCE WITH GOVERNMENT AID

The author shows that in Nigeria electricity output is rising at the rate of 20 per cent per annum and developments now in hand are likely to accelerate this progress. The projects include a hydro-electric scheme ultimately developing 2,000 MW

The Ijora "B" thermal power station

By A. E. BAILEY, M.I.E.E.*

LOAD development in Nigeria during the last few years has followed a consistently high pattern, output increasing at an average rate of over 20 per cent per annum. This rate of development is certain to be maintained and more than likely improved upon. The country is bursting with vitality and now, as Nigeria approaches self-government, foreign investment is pouring in with the result that light and heavy industries of a varied nature are being established at the major load centres and in several instances remote from existing areas of supply. In addition, the commercial and residential load is developing rapidly in all the areas in which the Electricity Corporation of Nigeria operates, and extensive construction programmes have been put in hand to meet this development and to bring electricity supplies to areas which have hitherto been considered too remote.

Development in Existing Areas of Supply

The Electricity Corporation of Nigeria, vested in 1951, and together with the undertakings taken over from the native authorities in 1952, was originally responsible for the operation of 17 undertakings. At 31st March, 1952, the value of fixed assets in service amounted to £2,428,844, and just over 78 million kWh was generated. By 31st March, 1960, the value of fixed assets had increased to £20,045,694 and the annual production to just over 360 million kWh. Capital expenditure is currently proceeding at between £4 million and £5 million annually on development of a general nature.

Total installed generating capacity, which in 1951 amounted to just under 20 MW, had by 31st March last increased to 139 MW, and the aggregate maximum demand had increased from 12 MW to 76 MW. Anticipating this rapid progress and the need to reduce operating costs, the Corporation examined the economics of establishing base load stations and constructing transmission networks to supply the small undertakings, at the same time opening up areas in which there was no electricity supply. The first major project of this nature was a 132 kV single-circuit transmission line linking Lagos with Ibadan. Concurrently, electricity supplies are to be taken to towns in the Western Region of Nigeria by means of a 33 kV system fed from this line. The 132 kV line will cost about £700,000, and the 33 kV system with an additional 18 township schemes will cost more than £400,000, financing being by means of an interest-free loan from the Western Regional Government. All this work is scheduled for completion by December next, and the system will be supplied in bulk from the oil-fired Ijora "B" power station. This station, which is at present being extended, will have an installed capacity of 85 MW of steam turbine plant. These extensions are scheduled for completion by July, and Ijora "B" will then be the largest thermal station on the west coast of Africa.

The 132 kV transmission system is to be extended from Ibadan to a switching station near the township of Ede, 53 miles north of Ibadan, at a cost of £250,000 to pick up the 33 kV network feeding the Oshogbo complex, which will then be extended to supply a further seven township areas in the Western and Northern Regions under the Corporation's new towns development programme.

In the Eastern Region of Nigeria, major development has been concentrated in and around Port Harcourt and is mainly attributable to the rapidly expanding operations of the Shell-B.P. Development Company. Vast reserves of natural gas have been found and to take advantage of this cheap fuel and at the same time meet the development in the area, a 60 MW gas turbine station is planned. Work has already commenced on this and the new station, which is to be sited in the Afam area near Port Harcourt, will initially have two 10 MW Brown-Boveri gas turbines. The station will be linked to the existing Port Harcourt and Aba undertakings by means of a double-circuit 132 kV line. Work has already commenced on the transmission system and is scheduled for completion by December. This initial development together with the Afam power station will cost about £1·8 million.

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Future planning envisages the extension of the 132 kV system from Aba to link up the transmission system at present fed from the Oji power station and supplying the Enugu, Onitsha, Abakaliki and Nsukka areas. Provision is also included for erecting a 33 kV line from Aba to Calabar, and the opening up of intermediate areas. On completion of this programme, all major undertakings in the Eastern Region will be interconnected by a transmission system fed in bulk from the Oji and Afam stations. Only one or two small remote stations will continue to operate individual diesel plant.

The Oji power station is being extended by the addition of a 10 MW steam turbine set which is due for commissioning this year, and the next 10 MW set which will bring the station to its full planned capacity of 30 MW is now being ordered.

In the Northern Region of Nigeria, development is mainly concentrated in the Kaduna and Kano areas, and the economics of linking the three stations—Kaduna, Zaria and Kano—by means of a double-circuit 132 kV transmission line are at present being examined. If this project is to go ahead the capital cost will be in the neighbourhood of £1 million.

In the meantime, to cope with the rapidly-increasing demand, additional diesel plant is being installed in the Kaduna power station, and work has commenced on the installation of 6 MW of free-piston plant at Kano at an estimated cost of approximately £400,000.

Major hydro-electric investigations in the Northern Region are dealt with in detail later in this article.

Development of New Supplies

In the past, development of electricity supplies in Nigeria has been slow. In a country about four times the size of the British Isles, the Corporation has until recently operated only 22 electricity undertakings, providing a supply to 29 townships. The main reasons have been the high cost of operating and administering small remote undertakings, and the paucity of revenue which can be anticipated.

However, some years ago, the Electricity Corporation of Nigeria carried out a study of the economics of developing electricity supplies at selected townships in Nigeria, and investigations were also made into the economics of establishing rural schemes for remote villages which could not normally expect electricity in the foreseeable future.

At the same time, the Regional Governments became interested in the development of electricity supplies in their respective regions, and to encourage this trend, the Corporation in 1958 decided to finance the establishment of one additional undertaking and one rural scheme in each region at a total cost of approximately £410,000. The townships selected were Ilorin, Ogbomosho and Umuahia, and the villages of Badagry, Bichi and Omoba were nominated for the rural schemes. The township of Owerri in the Eastern Region was later included and this increased the total cost of these projects to £500,000.

The rural schemes have all been commissioned and, operating only between the hours of 6.30 p.m. to midnight, with a minimum of staff, it seems that these small undertakings may be viable from the outset. Both the Umuahia and Owerri undertakings have also been commissioned. Ogbomosho will follow early in 1961 and Ilorin later in the same year.

Shortly after the Corporation announced its proposals for this development, the Western Regional Government asked it to provide electricity to a further 14 township areas in the region at an estimated cost of just under £900,000. This has been made available by the Government as a 30-year interest-free loan, repayable over the last 25 years, in addition to the £400,000 on the same terms for the development of 18 township schemes and their associated 33 kV systems to which previous reference has been made. In return the Corporation has undertaken to carry the initial losses in all these new areas.

The Northern Regional Government also nominated nine towns for inclusion in the Corporation's new towns development programme at an estimated cost of £600,000 and this has been made available to the Corporation by the Northern Regional Government on the same terms as the Western Region loan of £1·3 million.

Work under the new towns development programme has of necessity been awarded to contractors. The contract for the eleven towns which will form separate electricity undertakings, each with its own power station, has been awarded to Balfour Beatty & Co., Ltd., and the contract for the remaining townships, together with associated transmission lines, has been placed with the British Insulated Callender's Construction Co., Ltd.

The Eastern Regional Government has since decided to develop a supply of electricity at Nsukka, where a university is to be established, at an estimated cost of £158,000 which is to be made available by the Regional Government on the same basis as the loan made by the other two Regional Governments. This work, which covers some forty miles of 66 kV transmission and the Nsukka township reticulation, has been awarded as an extension of the Balfour Beatty contract.

All this is only the beginning of the tremendous surge which development is now experiencing in Nigeria, and the construction now in progress can be considered as "Phase 1" of the new towns development programme. Large sums are already being allocated by Regional Governments and by the Corporation to finance an extension of this development programme, and it is confidently anticipated that preliminary investigations into the township schemes to be included in "Phase 2" of the programme will shortly commence. This will follow on from "Phase 1" which is scheduled for completion by the end of 1961, by which time the number of towns supplied will have increased from 29 to 78—including the village schemes.

Hydro-Electric Development

It has long been appreciated that the one hope for a cheap and abundant supply of electricity is to develop the country's water power resources. In 1953, a hydrological investigation of the Niger and Benue Rivers was undertaken by Netherlands engineering consultants, on the instruction of the Federal Government of Nigeria, with a view to improving navigation on the rivers, and in 1957 an investigation into the hydro-electric possibilities of the Kaduna River at Shiroro Gorge was entrusted to Sir Alexander Gibb & Partners, jointly by the Electricity

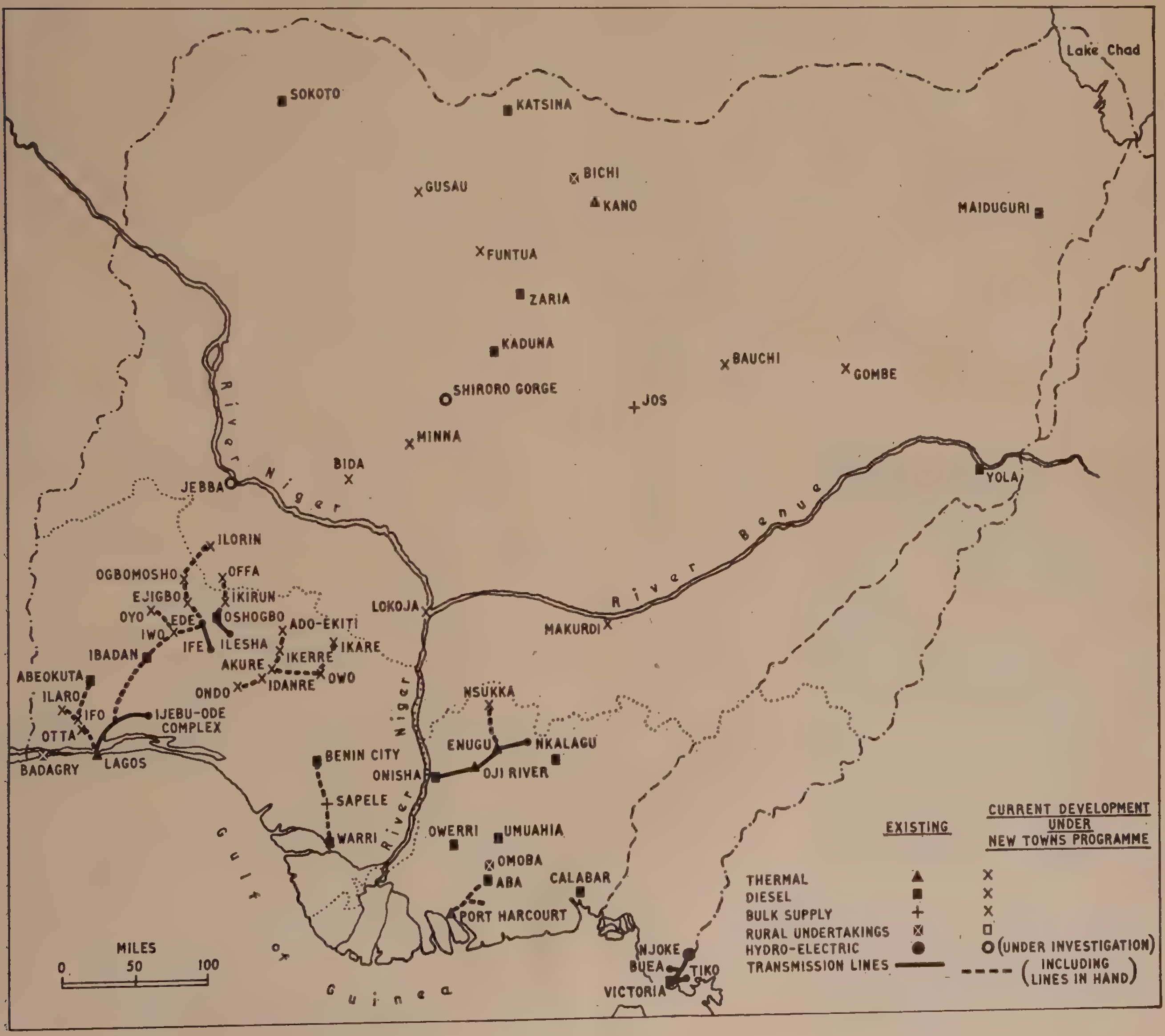
Corporation of Nigeria and the Northern Regional Government. In 1958 the Corporation commissioned Balfour, Beatty & Co. to undertake a preliminary examination of the potential of the Niger River at or near Jebba.

Shortly after this had commenced it was decided to co-ordinate the navigational and hydro-electric investigations of the Niger and as a result the hydro-electric and allied investigations, estimated to cost nearly £1 million, have been carried out jointly by Balfour Beatty & Co., Ltd., and N.E.D.E.C.O. working in full collaboration. Feasibility reports on both these proposals were examined by a working party consisting of Corporation and Federal Government officers last year. The result was a recommendation to integrate them by first developing a site near Kurwasa on the River Niger upstream from Jebba with a large reservoir, which would bring the river completely under control thereby giving maximum benefits to navigation, agriculture and fisheries, as well as providing at least 1,100 MW of firm power, followed by Shiroro and then a dam at Jebba itself. The consultants are now proceeding with the next stages of the investigation.

The proposed hydro-electric development envisages the ultimate development of the Jebba and Shiroro sites to enable them in combination to support each other so as to meet a demand of over 2,000 MW. The initial plant capacity of 225 MW will, it is estimated, cost approximately £57 million, including associated transmission lines from Kano to Lagos and Lokoja. This works out at something like £253 per kW, but it would improve to well under £100 per kW by the time the first station of the project was developed to its full installed capacity of 1,100 MW.

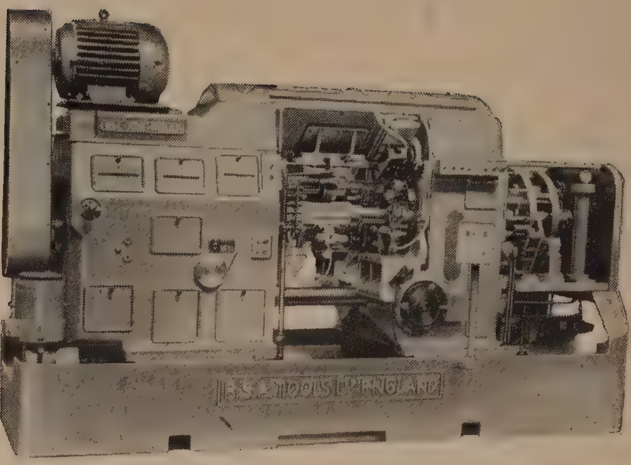
The hydro stations to be established in the Jebba and Shiroro areas are planned to feed north into the proposed Kaduna/Zaria/Kano 132 kV system and south into the Western Region transmission system with 220 kV or 380 kV lines feeding into the 132 kV system at Ibadan and Lagos respectively, and a 132 kV line down the Niger to Lokoja for irrigation pumping. Later development also envisages a 380 kV double-circuit line from the Jebba area across the River Niger to Oji which will feed into the 132 kV system at that point, and provide a supply to all the major stations in the Eastern Region.

Map showing the undertakings of the Electricity Corporation of Nigeria



Machine Tools at Olympia

International Exhibition of Machine Shop Equipment



A 40 h.p. motor is used for the main drive on the B.S.A. 7¼in automatic chucking machine

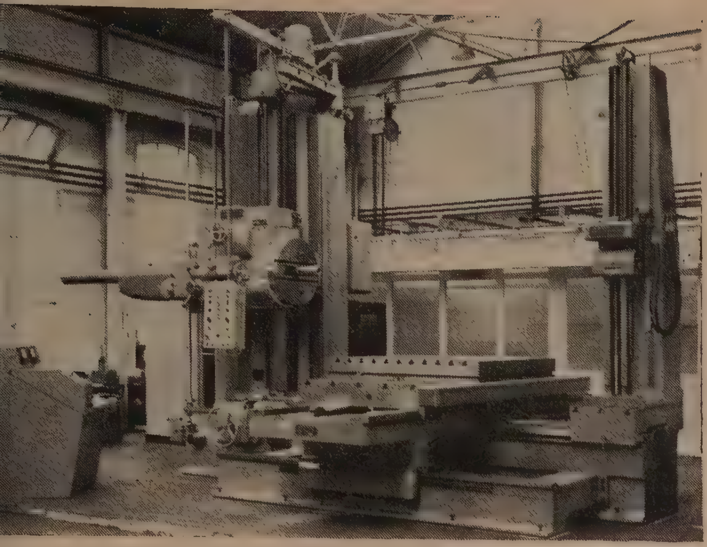
ELECTRICAL engineers concerned with production or with supplying motor drives and associated control systems must consider the International Machine Tool Exhibition one of the most important industrial displays. The ninth in the series of such exhibitions organised by the Machine Tool Trades Association since 1912 has been held during the past two weeks at Olympia. It was opened on 24th June by the President of the Board of Trade, Mr. Reginald Maudling, and closes today (Friday) at 6 p.m. More than 8,000 tons of machinery with an installed electrical load of 18·5 MVA has been included in the display of metal and woodworking equipment filling Olympia's three main halls and galleries. In the space available it would be impossible to cover such an exhibition fully, and our remarks must therefore be confined to certain items of electrical interest which came to our notice during our visit. A considerably fuller description is appearing in the June, July and August issues of the *Machine Shop Magazine*.

Typical of the machines on view is a new addition to the range of multi-spindle automatic chucking machines manufactured by B.S.A. Tools, Ltd. This has a capacity offering 7¼in diameter component swing with independent drives to all cross-slides by direct cam control and an electrical control for the drum shaft. The addition of electromagnetic clutches to the gearbox allows for the most acceptable positioning of the fast section trip controls on the lower cross-slide drum shaft end. Quick run and feed are controlled by two trips only, an electromagnetic brake automatically remaining applied until the drum shaft speed has been reduced from "quick run" to the required feed speed. The main drive motor is rated at 40 h.p. Also shown on this stand is a redesigned vertical broaching machine with a motor-operated cooling system. The electrical control panel now includes a fuse isolator switch, a pump isolator with overload protection and pushbutton control for the main 5 h.p., 1,440 r.p.m. motor. An ammeter is fitted to indicate the motor current.

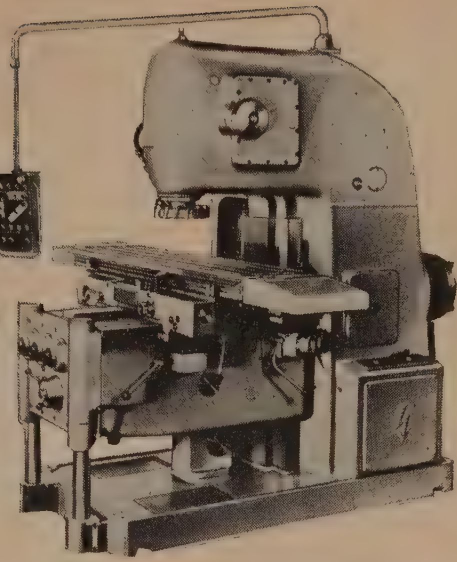
A heavy duty vertical milling machine is being exhibited by the Selson Machine Co., Ltd., set up for operation on a programme-controlled cycle. The 71 by 16in work table has a longitudinal movement of 47½in and the saddle a cross traverse of 16in. Twenty-four feeds, ranging from ⅜ to 79in per min longitudinally and transversely, and from $\frac{5}{32}$ to 31½in per min vertically, are provided by a 3 h.p. motor. Rapid power traverse at the rate of 126in per min can be applied to the table and saddle, and 49in per min to the knee. The individual motions of the machine are controlled by pushbuttons mounted on a pendant panel. Drive to the non-swivel cutter head is taken from a 15 h.p. motor, and 18 spindle speeds, ranging from 28 to 1,400 r.p.m., are provided.

Among the six machines on the stand of H. W. Kearns & Co., Ltd., is an all-electric universal horizontal surfacing, boring, milling, drilling and tapping machine which has a facing slide feed mechanism enabling the full power of the driving motor to be used during facing operations, and another equipment to carry out these operations in addition to screw cutting. This machine is fitted with the A.E.I. two-dimensional automatic co-ordinate setting system which comprises servo-mechanisms operating the vertical traverse of the spindle slide and transverse movement of the main table. Movements can be made to any position according to co-ordinates indicated on dials at the control desk. The dials can be automatically set by a reader from standard punched cards.

Much of the apparatus on show is of foreign manufacture. Among the exhibits shown by Matchless Machines, Ltd., is an electrolytic Agathon A.G. grinder in which the material to be removed is "dissolved." Finishes down to 0·006in can be obtained and on an average 1in square tool the complete cross-section can be removed at about 0·06in per minute. This is a low-voltage process operating at between 4 and 15 V and is inherently safe. Also on view is a machine developed by the Société Genevoise d'Instruments de Physique, in collaboration with Messrs. Agie (Switzerland), providing precise co-ordinate spark erosion machining of electrically conductive hard materials. It has a 16 by 10in working table with longitudinal and transverse travels of 8in. The work head has a vertical displace-



Kearns universal surfacing, boring, milling, drilling, tapping and screw cutting machine fitted with A.E.I. automatic co-ordinate setting system



Heavy duty vertical milling machine shown by the Selson Machine Tool Co., Ltd.

ment of 10in and there is a 6in automatic spindle feed range. Stock can be removed at rates up to 0·02 cu in/min. The generator can be connected to a 220/250/380/440/550 V, 50 or 60 c/s supply and the maximum connected load is 1·7 kVA.

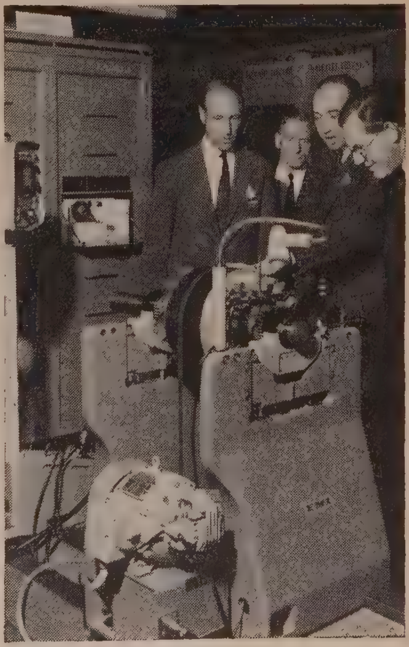
Control equipment for tools is widely featured. Although no actual equipment is shown on their stand, a pictorial display indicates the applications of A.E.I. electric motors, control gear and electronic controls to heavy machine tools such as an Asquith ram type borer equipped with contactor and electronic control gear and motors totalling approximately 220 h.p., and planer drives which have a closed-loop system incorporating a magnetic amplifier of the flux resetting pattern for controlling the variable voltage main driving motor and a magnetic integrator to give infinitely variable speed control over a wide range. Introduced at the exhibition by the Gear Grinding Co., Ltd., is an electronically controlled dividing engine having a platen which can be positioned angularly to an accuracy of ±2 sec, the positions being repeated to within ±¼ sec. It can be controlled manually using dial settings or automatically from a punched five-hole teleprinter tape. A wide range of electronic gauging equipment, control units, indicators and recording instruments is shown by Buck & Hickman, Ltd.

An optical method of measurement and control using moiré fringes is demonstrated by the National Physical Laboratory. Work by Ferranti, Ltd., in developing methods of copying and correcting long photographic gratings is shown on this stand, while the Ultra Electric Co., Ltd., have assisted in the development of electronic equipment for automatically controlling a screw-cutting lathe.

Included among the exhibitors showing control switchgear are Allen West & Co., Ltd., on whose stand are control panels for a vertical plano-milling machine and a 16in swing slide surfacing, screw-cutting and profiling lathe and a multi-motor panel for a bed-type automatic-cycle milling machine. Their type " UAC " air-break a.c. unit contactors available in ratings of 15, 25 and 50 A are also exhibited. The Midland Electric Manufacturing Co., Ltd., are displaying their range of " Memrex-Exel " switches and switchfuses and " Autoline " and " Memota " motor starters. Motor control exhibits on the Arrow Electric Switches, Ltd., stand include ranges of control circuit and automation control relays, the latter available with a latch attachment, and a series of direct acting 15 A contactors and starters. A cubicle isolator available in 30 and 60 A ratings designed for interlocking with the doors of control cubicles is also shown on this stand, and there is a range of multi-circuit rotary packet switches rated from 10 to 100 A for use on a.c. or d.c. circuits up to 600 V.

Armature Balancing Machine

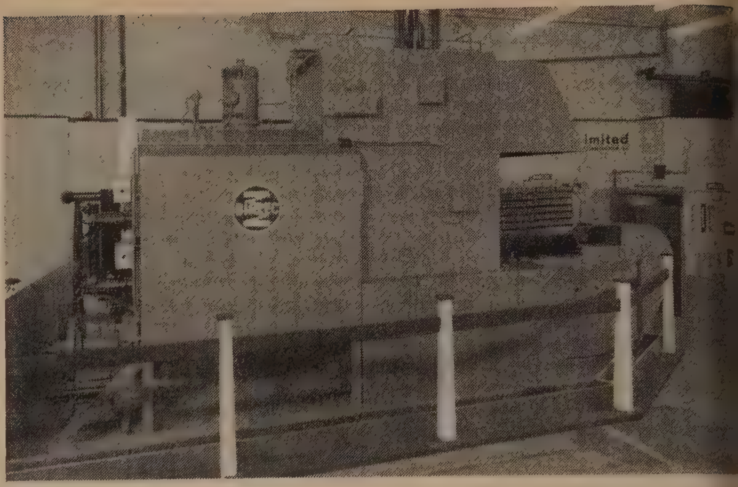
Introduced at the exhibition by E.M.I. Electronics, Ltd., is a dynamic balancing machine for use with high-speed turbines, armatures and other rotors weighing up



The E.M.I. dynamic balancing machine being examined by Mr. Reginald Maudling (right) to 250 lb. The use of a new type transducer and a new cradle suspension technique enables a bearing displacement of 8 μin (0·2 micron) to be detected. On the Newman Industries, Ltd., stand, an electronic timing device measures the effectiveness of the brake on a standard 10 cwt hoist unit fitted with a motor incorporating a disc type electromagnetic brake. This motor is one of a range from fractional h.p. to 40 h.p.

Included among the heating equipment exhibits is a 50 kW medium-frequency induction heater shown by Radio Heaters, Ltd. Operating at frequencies between 1 and 10 kc/s, the generator can accommodate power factor changes in the work circuit, and a two-stage output control compensates for the magnetic change which occurs in heating ferrous loads. Two capacitors with on-load switching contactors enable the full output to be maintained throughout the heating cycle. The larger of the two furnaces operating on the A.E.I.-Birlec, Ltd., stand is a sealed quench furnace having a working capacity of 9 cu ft. The straight radiant tube heating elements which can be used are now mounted horizontally, giving a longer life and permitting easier replacement.

A fully automatic mass production welding installation is employed on the Lincoln Electric Co., Ltd., stand to demonstrate submerged arc welding using two heads operating on a controlled automatic time cycle with automatic component clamping adjustable for both length and diameter. A shielded-arc hand-welding unit also shown provides full spot and tack welding facilities using the same hand gun, while a self-contained unit incorporating a recirculating water cooling system is on view powered by a constant voltage motor-generator which can provide a continuous output of 400 A for automatic welding. Spot welding equipment is prominent on the A.R.O. Machinery Co., Ltd., stand. A pedestal type unit using water-cooled electrodes has a secondary current of 13 kA with 2 × 14 s.w.g. mild steel sheet increasing to 16 kA on short circuit. The secondary open circuit voltage varies from 1·2 to 3·65 V. The maximum power of the unit is 45 kVA and it is capable of making up to 7,300 spot welds per hour on 2 × 16 s.w.g. sheet. There are two ranges of welding time, from 0·07 to 0·5 and from 0·25 to 2·5 sec.


Sealed quench furnace operating on the A.E.I.-Birlec stand

Gas Quality Problems in Electric Lamp Manufacture

A REPORT recently issued by the Industrial Gas Development Committee of the Gas Council, "The Solution of Problems Associated with Gas Quality Variation in the Manufacture of Electric Lamps," deals with experiences encountered by Cryselco, Ltd., at Bedford in the manufacture of electric lamps. The problems were tackled jointly by the Eastern Gas Board, the consumer and the Watson House Laboratories of the Gas Council. For some time, difficulties had been experienced in the fusing of glass used in the manufacture of electric lamps, namely blacking, under-melting and reduced production speed caused by wide variations in flame character within a short time. The most serious problems were experienced on machines producing the "foot" of the lamp, which is a glass tube into which the two wires carrying the filament are sealed. The glass used was a lead glass and the burners were normally adjusted to produce a slightly oxidising flame. Blacking is caused by reducing conditions and when these occurred temperature reduction took place simultaneously. Analyses of gas samples had proved inconclusive, and both gas and air pressures were governed and very little fluctuation occurred in either respect.

Modifications carried out on the sample batch of burners at the works by enlarging the flame port area, whilst proving more satisfactory, still gave unstable ragged cones on certain gases, and tests were undertaken with prepared gases, one of which was obtained by adding 15 per cent of air. The work on which the burners were used made a highly aerated flame necessary, and a 4 : 1 air/gas ratio appeared to be the minimum figure at which satisfactory results could be obtained without glass blacking taking place. It was therefore suggested that the burners used on automatically timed processes should be modified to give a 200 per cent increase in flame port area, and be used in conjunction with a controller.

The blacking effect on lead glass, i.e. the reduction of lead oxide, can often prevent maximum useful heat transfer. Variation or adjustment of burner centres could help but on the machines most affected by this problem these centres are fixed. By using a glass of different composition, this aspect of the problem was alleviated. The report includes a description of apparatus designed by the consumers' engineers incorporating a form of automatic proportioning of the air added to the gas.

Copies of the report, ref. 710/59, can be obtained from the Gas Council at Murdoch House, 1, Grosvenor Place, London, S.W.1.

Steam Display at I.E.E.

EXCEPT for a break during the last war, the Electrical Research Association has sponsored research on the properties of steam at the Imperial College ever since 1922. In conjunction with the Imperial College and Queen Mary College, a display has been mounted in the entrance hall of the Institution of Electrical Engineers showing, *inter alia*, the increase in plant efficiency with increase in steam temperature and pressure since 1700. The work was co-ordinated by Dr. W. B. Whitney, of E.R.A.

VIEWS on the NEWS

By "REFLECTOR"

ALL-ELECTRIC estates are not unknown in this country but in the United States, of course, things are on a bigger scale. Work is about to begin on "Electric City" in northern New Jersey. It will house about 30,000 people in a 2,500 acre area and the homes will be designed for "luxury living." There will be 6,000 of them as well as 5,000 apartment units (or, as we say, flats). They will be "electrically heated, wired for full housepower, designed to provide light for living and equipped with pushbutton, automatic electric kitchens." The enterprise is being undertaken jointly by the American General Electric Co., the Jersey Central Power & Light Co., and an estate development company. It would be interesting to have an all-electric "new town" here; if the Americans can do it we should not find it impossible.

* * *

It has been said that a good salesman is one who is capable of selling a refrigerator to an Eskimo, but *Aluminum News* (Montreal) says that in one area this has become a routine matter:—

> "In Canada's Northwest Territory, the North Rankin Nickel Co. is supplying free electricity to the homes of the Eskimos who work in the mines. As a result, the modern Eskimo igloos are well appointed with refrigerators, radios, washing machines and other modern conveniences."

Floor heating is not specifically mentioned. It is probably inappropriate in an igloo, but some critics of the system might say that with free electricity it becomes feasible.

* * *

The weather during the I.E.E. Summer Meeting last week was kind but occasionally threatening. When asked, one Glaswegian told us that forecasting weather in Scotland was simple. If you could see the hills, it was about to rain; if you could not see the hills, then it was raining. He was not a member of the North of Scotland Hydro-Electric Board, who are praying for rain.

* * *

Mr. C. Mills, of Yeovil, who read my recent paragraph on the dangers of overhead lines to the pilots of aircraft spraying crops, has sent me a cutting from the *Western Gazette*. This is a report of an accident to a light aircraft which became entangled in an overhead line while treating a potato field with fungicide. Perhaps undue prominence is given to the fact that the district's electricity supply was cut off for five hours, but I am pleased to see that the pilot suffered only a leg injury in freeing himself from the wreckage of his machine.

* * *

Another case has occurred in which a man working on the site of a demolished building received a fatal shock because the electricity supply to the old building had not been cut off or sealed off. There seems again to have been a misunderstanding for although it was said in evidence that the Electricity Board had been notified by telephone the intake equipment was not made safe; the Board denied knowledge of the telephone call. This is an example of unsettled responsibility. Should the building contractors make sure that the supply is cut off? Or should the Electricity Board keep a look-out for such cases and take the necessary action? I seem to remember an instance some time ago in which a child was electrocuted by interfering with electrical gear on a derelict bombed site. Here the responsibility clearly rested on the supply authority. Electricity Boards should generally know when premises are abandoned and act accordingly.

* * *

Last week I quoted extracts from an *Electrical Review* of eighty years ago on the possibilities of electric traction, which were thought to be limited. Ten years later the *Review* (11th July, 1890) published a much more encouraging paper on the subject. The author, after dealing with developments, mainly in America, said:—

> "But this aside, let us cast a prophetic glance forward to the electric express train of the future. It may consist of a motor car, very likely pointed at the front to lessen the resistance of the air to its swift passage, and containing one or more powerful motors directly on the axis of its drivers and aggregating perhaps 1,000 h.p. as a nominal output. . . . Its only lights by night will be incandescent lamps; its only means of heating electric heaters distributed through the train. . . . A third rail or a strong bronze wire above will convey current to the motors, and power for it will be supplied by a series of stations perhaps 20 or 30 miles apart along the line. The train will start smoothly into motion, fly along the track at the highest rate of speed that is found practicable, and stop quickly and easily by applying its electric brakes. The system of distributing power can be easily converted into an automatic block system that will secure beautiful control of the trains and almost absolute immunity from collisions."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Satisfactory Passenger Transport

THE article in the *Electrical Review* of 27th May on the Bournemouth trolley-buses proves conclusively that where this form of transport is operated intelligently and in the sphere for which it is suited, namely, on routes having a frequency of not less than ten minutes and a fixed density of traffic, it is not only more economical than the diesel bus but can be an object of civic pride. In addition, trolley-buses have a great advantage in that they do not add to the nerve-racking noise of urban traffic or to the serious menace of air pollution. A service to the public is assured even in the event of oil supplies being cut off by political or enemy action.

Apart from the foregoing, the overall economics of replacing trolley by diesel buses does not make sense. The oil consumed by the latter is an import and acts adversely against the balance of trade. Moreover, the cost, in effect upon public health, and therefore on the National Health Service, must be astronomical.

A recent example of what occurs is found in Portsmouth where, against strong opposition from all the Ratepayers' Associations and the Trades Council, a decision was taken to abolish the profitable and most efficient trolley-bus system which, last year, made a profit of £27,000 as compared with a paltry £7,163 contributed by a fleet of diesel vehicles three times as large. The fight in the council chamber was lost and a referendum was refused, although the scrapping protagonists failed to produce any valid reasons why the trolley-buses should be abandoned. Already, a route constructed only four years ago is disused, the ludicrous situation obtaining that one-man single-deck buses have to run in duplicate at week-ends, in place of the double-deck trolley-buses—a supposed economy in operation!

One can only hope that sanity and commonsense will prevail before more trolley-bus systems are scrapped, since this is so clearly a move which is in neither the interests of the public nor of the nation.

" TRANSPORT OFFICER."

Delayed Increases

WHAT an indictment of the " employers " in electricity is the recent N.J.C. award. For months they denied the truth of N.A.L.G.O.'s assertions that electricity employees were underpaid as compared with others doing similar work. Twice arbitration had to be sought until increases long overdue of from £50 to £215 were obtained back-dated to 1st December, 1959.

Should not the first job of good employers be to look after their employees? Since the war electricity has gone ahead by leaps and bounds; it is agreed even by opponents of nationalisation that here is an industry that becomes more and more efficient, and the productivity of its workers improved, every year. Should not the employers recognise this and not wait for the unions to go to them cap in hand? Isn't it their job to keep an eye on what is paid outside and to offer their employees similar increases? Must the employees always say " Please! " and the employer always reply " Well, perhaps next year. . . ."

I suppose the A.M.E.E. and the E.P.E.A. will now have to go along and ask for a bit more. Frustration and irritation do more harm to the industry than a dozen thunderstorms. What respect we would have had for our employers if they had said when the N.J.C. award was announced:—" We are aware of the discrepancies and anomalies this award creates. We would assure those paid under the Management and N.J.B. Schedules that, after discussion with their respective Associations, we shall be pleased to bring into effect from 1st December, 1959, commensurate increases."

Will they be so generous—indeed will they be just? Or will the whole dreary procedure be gone into all over again with the employers trying once again to whittle down the just requests, most certainly refusing to back-date any increase to 1st December last saying, in effect, " You should have asked before. . . ."

I would suggest that reprints of Mr. L. J. Luffingham's article " Management in Electricity Supply " printed in your issue of 27th May be issued to all members of negotiating committees. The article has a sub-heading " According the Proper Treatment "! The exclamation mark is mine.

We are proud of the national service we provide—are our employers proud of us?

S. K. TAYLOR.

Nuclear Science Research

THE activities of the National Institute for Research in Nuclear Science during the year ended 31st March, 1959, are described in the recently published second annual report. The principal object of the Institute is to provide, for use by university scientists, facilities for research in nuclear science which are beyond the scope of individual universities for reasons of size or cost. Its work is centred at its first laboratory, the Rutherford High Energy Laboratory, adjacent to the Atomic Energy Research Establishment at Harwell, in Berkshire, and good progress was made in the construction of the laboratory during the year. The major project, not due for completion until 1962, is the construction of the proton synchrotron " Nimrod " for accelerating protons to energies of 7,000 MeV. This machine was described in the *Electrical Review* of 5th February last. A 50 MeV proton linear accelerator is also under construction.

Domestic Supplement – Electric Fires – at the end of this issue

I.E.E. Summer Meeting

At the invitation of the Scottish Centre, the 1960 Summer Meeting of the Institution of Electrical Engineers took place in Glasgow last week. This year's venue was particularly appropriate since, during the season, the Scottish Centre celebrated its diamond jubilee. As in previous years, the meeting followed the same pattern of visits to power stations, industrial establishments and places of local tourist appeal as well as the usual formal evening events. In a few cases, special alternative visits were arranged for the ladies.

About 550 members took part in the meeting of whom some 120 were from the local Centre. Nearly 40 alternative visits were arranged, so that it is obviously impossible to give more than an outline of each. A typical day consisted of a visit from 9 a.m. to 5.30 p.m. and a dinner-dance from 7 p.m. to 1 a.m. It was thus a very full programme which required considerable organisation and endurance on the part of individual members and by I.E.E. officials during the five days of the meeting. The excellent organisation of the various parties was mainly due to the work of the hon. secretary of the Scottish Centre, Mr. John de Villiers.

The visits to the various power stations and factories were pleasant and informative both for members and their ladies. We were impressed by the reception given by the firms visited and their hospitality at lunch after excellent guided tours of their factories. The return journey to Glasgow often included a tour of the countryside.

The proceedings opened with a civic reception at the City Chambers on Monday evening, followed by dancing and a concert given by the Kirkintilloch Junior Choir. On Tuesday morning, the delegates formed into separate parties for nine alternative visits. One party visited the Kincardine power station of the South of Scotland Electricity Board which, when completed, will have a total capacity of 760 MW (see *Electrical Review*, 15th May, 1959). Another party went to the Board's Hunterston nuclear power station under construction on the Ayrshire coast. This station, which is due for commissioning in 1963, will have two reactors, each rated at 180 MW (electrical). A graphic illustration of the station appeared in the *Electrical Review* of 26th April, 1957. Two other visits were arranged on the same day to hydro-electric power stations of the North of Scotland Hydro-Electric Board. One party went to the Loch Sloy scheme and, apart from visiting the power station on the shores of Loch Lomond, they were able to view the dam at Loch Sloy. They were then entertained to lunch by the English Electric Co., Ltd., in the power station. The other hydro-electric plant visited was Lochay power station at Killin, near Loch Tay in Perthshire. This station also contains the Breadalbane group control centre. The industrial establishments visited on Tuesday included Scottish Cables' Renfrew works. After lunch this party toured Paisley Abbey. Those who visited the Dalzell steel works of Colvilles, Ltd., in the morning were taken round the A.E.I. Motherwell factory in the afternoon, where various types of meters, relays and X-ray equipment were to be seen. At the works of the Harland Engineering Co., Ltd., Alloa, another party saw the manufacturing of motors, pumps and generators. The Greenock works of Joy-Sullivan, Ltd., which specialise in mining machinery, were also visited. At the invitation of the Clyde Navigation Trust, other members were taken for a tour of the harbour and docks in the Trust's tug and, in conjunction with the Simon Handling Co., Ltd., visited the Trust's Meadowside granary.

Group on the dam at Loch Sloy

Messrs. S. F. Brown, E. Taylor, F. J. Hutchinson and J. A. McCash at the works of Glenfield & Kennedy, Ltd., Kilmarnock

In the evening, delegates went to the Alhambra Theatre, Glasgow, at the invitation of the General Electric Co., Ltd., to see the " Five-Past-Eight Show " and were afterwards given an excellent dinner which had been listed in the programme as a " buffet supper."

Visits on Wednesday included a tour of Bruce Peebles' works, where the manufacture of rotating plants of all types, transformers and electronic apparatus was seen. Another party went to the Ferranti works and saw the production of computers, electronic machine tool controls, aircraft navigation and radar devices. At the Kilmarnock

Left: Mr. P. W. H. Curtis (East Midlands Electricity Board) and Mrs. Curtis. Right: Messrs. L. H. Dickerson (North of Scotland Hydro-Electric Board) and J. E. Sayers (chairman, South-West Scotland Sub-Centre of the I.E.E.)

works of Glenfield & Kennedy, Ltd., a further party saw the manufacture of large water valves and other hydro-electric equipment. Babcock & Wilcox, Ltd., entertained some of the members who toured the Renfrew works where high-pressure boilers, cranes, etc., are produced. At the works of the Belmos Co., Ltd., where all types of switchgear and control gear and electronic equipment were seen, the party also inspected the short-circuit testing laboratory. Another party visited the lace factories of Henderson, Morton, Inglis & Co., Ltd., and Johnston, Shields & Co., Ltd. The remaining members took part in an excursion to Loch Lomond and the Trossachs as the guests of A.E.I., Ltd.

On Thursday, the visits to Kincardine, Hunterston, Loch Sloy and Lochay power stations were repeated for some of those unable to attend on Tuesday. Scottish Cables' Renfrew works were also visited again, and in the afternoon this party went to the shipyards of Alexander Stephen & Sons, Ltd. There were also five other alternative visits. One of these was to the North British Locomotive Co.'s Glasgow works in the morning, where the production of diesel-electric, all-electric and diesel-mechanical locomotives was seen and in the afternoon to the James Templeton carpet factory. At the invitation of the Distillers Co., Ltd., one party visited the Cambus distillery and in the afternoon toured Stirling Castle. At the Kirkintilloch works of M. & C. Switchgear, Ltd., the manufacture of various types of switchgear and control gear for industrial and mining use was shown to a number of the delegates and in the afternoon these members visited the Bishopbriggs printing works of Blackie & Son, Ltd. Two other parties visited television studios and transmitting stations. The first party went to the B.B.C. Glasgow studios and the Kirk O'Shotts transmitter and the second to the Scottish Television Glasgow studios and Blackhill transmitter.

In the evening, the I.E.E. dinner-dance at the Central Hotel was attended by 420 members and their ladies. The President of the Institution, Sir Willis Jackson, was in the chair and proposed the toast to "The City of Glasgow." He referred to the excellent work of the Scottish group training scheme (S.E.T.S.) and hoped that it would be adopted as a model on a larger scale. Bailie William Brown, Senior Magistrate of the City of Glasgow, in a witty reply said that he hoped that electrical engineers would continue to work for the benefit of mankind and not be too commercial in their outlook. The toast to the guests was proposed by Mr. James A. Aked, chairman of the Scottish Centre, and Lord Strathclyde, chairman of the North of Scotland Hydro-Electric Board, replied. The future of the industry, said Lord Strathclyde, depended on finding young men who could be trained in managerial skills and not only in technology.

On Friday, the whole party were the guests of A. Reyrolle & Co., Ltd., on an all-day cruise on the Clyde to the Kyles of Bute. The programme concluded in the evening with a supper, dance and cabaret at the Central Hotel where the hosts were Bruce Peebles & Co., Ltd. In a short welcoming address, Mr. W. B. Laing, managing director of Bruce Peebles & Co., Ltd., marvelled at the resilience of members during a rather punishing week. Sir Willis Jackson then took the opportunity to express the collective thanks of the members to all those firms and individuals who had helped to make it a most memorable meeting.

Group outside Loch Sloy power station

RUBBER GLOVES

THE revised 17-page publication B.S. 697 : 1960, "Rubber Gloves for Electrical Purposes," specifies requirements for gloves for use at four different voltage potentials, up to 650, 1,100, 3,300 and 4,000 V. The gloves may be made by dipping or moulding processes or be built up from sheet rubber. A feature of the revision is that the voltage withstand test for each glove is now required to be carried out twice by the manufacturer. The second test has been introduced to detect those gloves which have a tendency to pick up excess moisture, thereby reducing their dielectric strength. Research work into this phenomenon has been carried out by the Electrical Research Association, who have taken an active part in the re-drafting of the standard. An appendix to the standard contains a series of notes relating to the maintenance of the gloves after purchase. The B.S.I. Kitemark monogram may be applied to the gloves if the manufacturer is licensed to use it.

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s.

INDUSTRY AND THE HOUSE

Re-sale of Nationalised Undertakings

By **AUSTEN ALBU**, M.P., B.Sc., A.M.I.Mech.E., M.I.P.E.

BEFORE Whitsun Parliament did little that was of direct interest to industry, but since the recess there have been a number of debates and Ministerial statements of concern to industrialists. The slowing-down of the nuclear power programme was not unexpected, but will undoubtedly be the subject of debate in the near future. Pressure is being applied to Ministers by a powerful lobby of industrialists who want to see Britain go in for a space research programme. Some members, on both sides of the House, realising the heavy cost of such a programme in money and scientific manpower, have put down a motion calling for collaboration with European and Commonwealth countries.

Government and the Steel Industry

A real clash of political philosophies took place on Monday and Tuesday of last week when the Opposition initiated debates on the Government's announced intention to sell the still nationalised steel firm of Richard Thomas & Baldwins and the publicly-owned instrument making company of S. G. Brown, Ltd., back to private interests. Both attacks were mounted by Mr. Fred Lee, who is chairman of the group of members sponsored by the Amalgamated Engineering Union. Mr. Lee described the history of the Government's relations with Richard Thomas & Baldwins as a " a sordid story." R.T. & B. was a very successful enterprise and the operation was only for the purpose of transferring the profits from the public purse into the pockets of the equity shareholders. He pointed out that the steel industry had not provided the expansion in capacity which the Iron and Steel Board had thought necessary in 1955. This was especially so in sheet, imports of which were rising rapidly. In the first quarter of 1960 total steel imports were 192,000 tons compared with 65,419 tons in the first quarter of 1959. If the latest figures were maintained throughout the year the cost to us would be £68½ million. R.T. & B. represented the last chance of exercising any public influence over the private steel owners.

It cannot be said that Mr. Wood, the Minister of Power, made a very convincing case for the change, except on the grounds that it was part of Government policy which had been supported by the electors at two General Elections. He refuted the argument that the Government should retain what he described as a " chosen instrument " in order to be able to increase capacity if necessary. He thought the argument gave far too little weight to the achievement of the Board in inducing additional capacity when necessary. After the excitement generated by Mr. Lee's speech, and some interruptions of Mr. Wood's from the Opposition Front Bench, it was something of an anti-climax when the Minister, after considering the needs of the company for finance additional to the £70 million recently provided by the Government, said that maybe the sale of the equity capital of R.T. & B. could be more advantageously carried out when the present plans were further advanced and there were signs of the company's increased earning capactiy.

It was perhaps inevitable that the excitement of this debate could not be carried over to the next day when Mr. Lee tried to repeat his performance by an indignant attack on the Government's sale of S. G. Brown to de Havillands and the American Bosch Arma Corporation. He made a good deal of the danger of control of the company leaving this country; but his main argument was that this company, which had developed an outstanding master reference gyro compass, should have been retained in public hands. The Civil Lord of the Admiralty, Mr. Orr-Ewing, said that there were four considerations in the sale: the business was to be kept as a going concern; it was to carry on with existing projects; it must avoid the danger of creating a monopoly in the firm's field of work; and the firm must not come under foreign control. Further, the sale must not damage the 1957 licensing agreement with the Bosch Arma Corporation.

Mr. Orr-Ewing defended the sale on the grounds that the firm had a bank overdraft of £440,000 and that the taxpayer through the Admiralty had furnished substantial sums in the form of ordinary shares, debentures and loans. This brought Mr. Harold Wilson to his feet to compare these sums with the loan of £50 million to Colvilles, the steel firm, and to ask whether these sums appeared " above the line " in the Admiralty vote where current expenditure occurred, or " below the line," which was mostly concerned with estimates for capital expenditure on which a return was likely. To this Mr. Orr-Ewing did not reply except to say that the firm would need more than £250,000 of new capital. Mr. Wilson pointed out that if the firm made profits after the sale, de Havillands would collect them; but if it made losses, de Havillands would be more than compensated by payments out of what he called " the Minister of Aviation's special aircraft industry national assistance board." The President of the Board of Trade defended the Government's action on the grounds that the company needed risk capital which should come from private enterprise; that it would be helped by the tie-up with a large sales organisation; and that the link with Bosch Arma would give it contact with a company making a complementary set of products.

Apprenticeship Opportunities

In the same week a short debate on apprenticeship was opened by your contributor. He drew attention to the challenge and opportunity presented by the " bulge " in school leavers that would take place in the next few years. By 1962 it was expected that there would be 494,000 15-year-olds leaving school in England and Wales. The peak for 16-year-olds would be reached a year later, with 121,000. The proportion of boys entering apprenticeships or learnerships in skilled trades had declined from 39 per cent in 1956 to 34 per cent in 1959. The number of boys receiving day release for technical education had declined from 192,000 to 187,000 and the number of girls had risen slightly from 50,636 to 51,743. Even in engineering and shipbuilding the proportion of boys released had fallen from 73·9 per cent to 58·5 per cent. The chances of apprenticeships varied greatly from industry to industry and in different parts of the country. He said that the Government had the responsibility of determining whether there would be jobs for those leaving school and that if there were jobs whether they would be heart-breaking dead-end jobs or jobs with opportunities for training. Would the quality of training match the needs of our industry in the future? It was suggested that the Government should bear a greater part of the responsibility for training by extending the scheme for first year training in Government Training Centres and even providing complete courses. We should get away from the concept of apprenticeship as entry to a trade or profession and look upon it solely as training. The responsibility for it should be transferred from the Ministry of Labour to the Ministry of Education.

The Parliamentary Secretary, Mr. Peter Thomas, gave figures on the unemployment of youngsters. Over the country as a whole 0·8 per cent of Easter school leavers were unemployed on 13th June. Even in the Northern Region all had been placed in work except 2·5 per cent. In June there were vacancies for 116,500 and unemployment among those between 15 and 18 years of age was 11,700. He said that a hopeful sign was the steady increase in the quite high proportion of young people who had not taken up employment by the age of 18; from 21·4 per cent in 1956 to 23·7 per cent in 1958. This reflected the extended use which was being made of opportunities for higher education. A circular had been sent to all local education authorities which suggested that technical colleges should develop full-time courses of education and training covering the theoretical and practical work normally carried out in the first year of apprenticeship. The number of places at the Letchworth Staff College for Industrial Supervisors was being increased and priority given to apprentice instructors.

Mr. Cyril Bence, also an A.E.U. member, criticised many existing apprentice schemes as too narrow. The Minister of Labour, replying to the debate, said there was a great need for skilled men. There was the closest co-operation between his department and the Ministry of Education. He welcomed the suggestion that there should be local organisations similar to the Industrial Training Council. He believed that the problem of providing appropriate training should be left to industry. The Government tried to achieve results by providing information and by using persuasion and influence whenever they could. The more discussion we have on the subject the better.

New Course for Contracting Apprentices

IN the electrical contracting industry it has been found that far too many apprentices have not been able to, or have not put themselves out to, take advantage of the educational facilities open to them and in consequence day release for apprentices has become widely regarded by the employers as an unjustifiable expense. To encourage a wider range of entrants into the industry to take some form of training, the National Federated Electrical Association has collaborated with the City and Guilds of London Institute in the introduction of a new electrical installation course, to be known as " Course A."

This course, which will be available at technical schools for the first time in September next, is designed to cater for entrants aged 15 plus with a lower academic standard and will lead to the award of the Institute's Electrical Installation Craft Practice Certificate. It will be one of three years. The emphasis will be on practical training and knowledge, and with only such related studies as are essential to enable a practical electrician to carry out his duties under supervision. The studies embodied in the first year of the new Course A may also be regarded as providing appropriate preliminary training for entry into Course B and apprentices who complete satisfactorily the first year of Course A may, at the discretion of the college principal, be admitted to the first year of Course B, " Electrical Installation Work," without further preliminary training. Those who complete the full three years of Course A and who wish to proceed to Course B may, at the discretion of the college principal, be admitted directly to the second year of Course B.

Course B will still be regarded as the " standard " course for journeymen electricians. It is intended to afford the requisite technical and practical knowledge to enable a journeyman electrician to carry out his work with proficiency, without detailed supervision.

PRESSURE COOKERS

THE new British Standard B.S. 3244 : 1960, " Pressure Cookers with Embedded Elements (Safety Requirements)," specifies safety requirements for pressure cookers in which the electric element is cast into the base of the cooker pan. Cookers of above 5 gal capacity and those not generally regarded as being for domestic use are excluded. The requirements are the same as for the externally heated cookers dealt with in B.S. 1746, with the addition of performance tests for heating elements, thermostats, earthing, current leakage, and general electrical safety when the appliance is in use. Except where necessary to ensure that the cooker is safe, dimensions and design details are not specified. One of the standard's marking requirements is that each cooker shall be plainly and permanently marked, " WARNING—read instructions before use."

Copies of B.S. 3244 may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 4s 6d.

INDUSTRIAL NEWS

Engineering Production and Orders

Production in the electrical engineering industry in the first quarter of this year was 15 per cent higher than a year earlier. The later figures available for the combined output of the engineering and electrical goods industries show that in April, which this year included the Easter holiday, production was 6 per cent higher than in April, 1959. Taking March and April together, the increase was 13 per cent, about the same as in January and February. Almost the whole of the increase in the early months of this year, the Board of Trade state, was in capital goods; manufacturers' deliveries of engineering consumer goods appear to have turned downwards in the first quarter.

DELIVERIES OF MAIN ELECTRICAL ENGINEERING PRODUCTS (£ million)

	Year	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Rotating electrical machines	1959	27·1	30·9	33·1	37·8
	1960	*31·5*			
Transformers for lighting, heating and power	1959	10·2	10·1	9·9	11·7
	1960	*11·1*			
Switchgear and control gear	1959	26·7	27·8	25·0	29·1
	1960	*29·1*			
Other electrical machinery	1959	3·5	4·0	4·3	4·4
	1960	*5·1*			
Insulated wires and cables	1959	29·5	29·1	26·8	31·4
	1960	*33·2*			
Domestic electrical appliances	1959	28·8	34·5	34·5	40·4
	1960	*32·8*			
Electrical equipment for motor vehicles, cycles and aircraft	1959	13·2	16·1	13·3	16·2
	1960	*15·7*			
Primary batteries	1959	3·0	2·8	3·2	3·6
	1960	*3·1*			
Secondary batteries (accumulators)	1959	5·0	5·7	5·4	7·3
	1960	*6·6*			
Electric lamps	1959	5·0	4·3	4·3	5·7
	1960	*5·8*			
Other electrical goods (except radio, telecommunication and other electronic apparatus)	1959	16·6	17·2	16·8	20·9
	1960	*21·2*			

New orders, mainly for capital goods, indicate that demand is buoyant. The volume of orders on hand increased again in April and at the end of the month they were at about the same level as at the beginning of 1958.

Hire-purchase Advertisement Case

What is said to have been the first prosecution under Section 3 of the Advertisements (Hire-purchase) Act, 1957, was heard at Bow Street Magistrates' Court on 1st July when Vactric, Ltd., were fined £10, with 10 gns costs. Counsel for the Board of Trade, which undertook the prosecution, said that the advertisement on which action was taken appeared in a newspaper on 7th February. Although it gave particulars of deposit, cost price and payment period for a washing machine the weekly payment was given undue prominence. The Act provided that, for the protection of the consumer, undue prominence must not be given to any particular detail. There would have been no objection if all the figures had appeared in type of the same size.

New York Exhibition

The stand of Tube Investments, Ltd., at the British Exhibition, New York, was co-winner with the Worshipful Company of Goldsmiths in a contest to select the best-designed display which had been sponsored by the Worshipful Company of Goldsmiths. The panel commended T.I. for "interesting use of less dramatic subject matter." The stand, designed by Mr. Leslie Gooday, London architect, was organised by T.I. (Export), Ltd.

A.E.I. Summer School

Thirty professors of electrical engineering from leading universities and technical colleges in Britain, together with three colleagues from overseas, are attending a summer school organised by Associated Electrical Industries (Rugby), Ltd., from 11th to 17th July. At the opening session of the school, which is the fourth to be held at Rugby since the war, the guests will be addressed by Sir Willis Jackson, D.Sc., F.R.S., President of the Institution of Electrical Engineers, who will speak on "The Relation between the Industry and the Universities." As well as listening to lectures concerning the application of the latest scientific and mathematical knowledge in the manufacture of electrical equipment, the professors will visit various A.E.I. works and laboratories, including a new research laboratory at Rugby.

Electricity Supply Clerical Staff Salaries Increased

The National and Local Government Officers' Association has notified us of new salary scales awarded by a special tribunal and taking effect from 1st December last. These affect clerks, typists, machine operators, assistant demonstrators, telephonists, assistant nurses and the higher clerical, administrative and commercial staff. In all cases there are appreciable increases.

Electrolux Display Factory

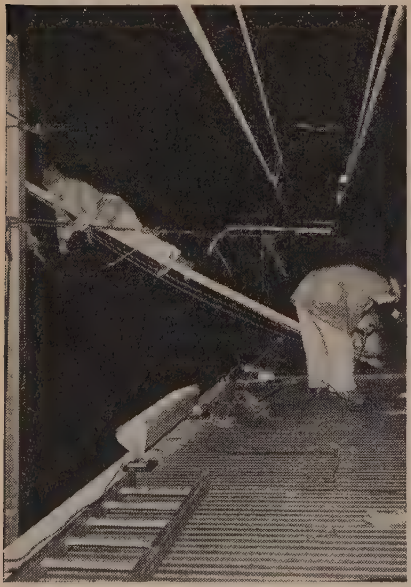
Point-of-sale display material in several languages, and in many cases specially treated to give a long life under tropical conditions, is being produced in a new factory built by Electrolux, Ltd., at St. Albans. The extensive design and production facilities provided to meet the company's requirements for the manufacture in quantity of a wide range of advertising displays and sales aids for their refrigerators, vacuum cleaners and floor polishers are kept working at an even load by taking in outside work. Among the display division's clients are several Electricity Boards, advertising agents and manufacturers of toys, beer, shoes and biscuits. In addition, the factory produces certain wooden parts used in the company's

Display fitting assembly at the Electrolux factory refrigerators, and the dual-purpose plastic tray tops.

Display work calls for considerable versatility and each production section is designed to cope with every class of work from a single copy up to runs of 10,000 or more. All displays are assembled on jigs to ensure complete interchangeability of parts. The works is divided into six areas: a wood mill, equipped with the latest type of machines; construction and assembly shops; spray shops; a silk screen printing section; a special unit assembly section; and packing and dispatch department. The factory occupies an area of 30,000 sq ft and there is room for extension on the 3 acre site. The staff at present number a hundred.

Lighting for Railway Electrification

Much of the installation work on British Railways' electrification schemes is being done in artificial light. Installed on the construction trains B.I.C.C. are using for the electrification of the Eastern Region are new galvanised, heavy-duty, single lamp, fluorescent type fittings incorporating a heavy wire guard and a special aluminium reflector to give maximum illumination at working level. By fitting four of these units per carriage, an illumination of about 5 lumens per sq ft is obtained at contact wire level. Power is supplied, via roof-mounted waterproof sockets, by a 250 V, 50 c/s generator fitted inside one of the vehicles in the wiring train. Being mounted along both sides of the carriage, the fittings provide a positive indication of top-deck roof width. They can be easily removed when the trains are not in use. The fittings were designed by Falk, Stadelmann & Co., Ltd., in co-operation with B.I.C.C. and the chief mechanical and electrical engineer for the British Transport Commission (Eastern Region).



One of the Falk's fittings in use on a wiring train

Brit.I.R.E. History

Under the title "A Twentieth Century Professional Institution," the British Institution of Radio Engineers has published its life story. It is said that the formation of the Institution was an expression of the need to encourage education and training in radio and electronics. It was formed in 1925 and was originally known as the Institute of Wireless Technology; the present style was adopted in 1941. The present volume covers the activities of the Institution in a dozen or so sections, including education and technical training; craftsmen and technicians; the library and technical services; the Institution's conventions, which began in 1934; services to members; overseas sections; and co-operation with other bodies.

Benjamin Lighting Fittings in Australia

The Benjamin Electric, Ltd., of London, and Bradley's Electrical Industries Pty., of Sydney, have amalgamated to form a new company in Australia, with the title of the Benjamin-Bradley Electric (Pty.), Ltd. The standard ranges of Benjamin tungsten and mercury lighting fittings, including those for fluorescent lamps, and Benjamin floodlights, are available through the new company, whose offices and works are at 145, Parramatta Road, Five Dock, Sydney, New South Wales. All future communications concerning Benjamin lighting equipment in Australia should be sent to this address.

Four-day Week at G.E.C. Cooker Factory

Last week the General Electric Co., Ltd., announced that it was instituting a four-day week at its Swinton (Yorks) cooker factory. It was stated that the decision was arrived at because of "a high stock position" in relation to a new cooker with two (instead of three) boiling plates which had not been readily received by the public. Hire-purchase restrictions were given as a further reason. By working a shorter week it would be possible to avoid the dismissal of about 300 of the 1,200 workers employed at the factory.

Orders for Computers

Twelve orders worth more than a million pounds have been received by International Computers & Tabulators, Ltd., for their new business computer, the I.C.T. Type 1301 data processing system. Three of the orders are from overseas, two from Sweden and one from Australia. The 1301, a fully transistorised magnetic-tape computer of advanced design and high performance, is a product of the combined experience and technical knowledge of I.C.T., Ltd., and the General Electric Co., Ltd.

Engineers' Exhibition Dinner

Application forms for tickets for the first annual dinner in connection with the Electrical Engineers' Exhibition are now being circulated. The dinner is to be held on 13th October at Grosvenor House, London, W.1, and tickets will cost £2 2s each; they may be obtained from the general manager, Electrical Engineers' Exhibition, 6, Museum House, 25, Museum Street, London, W.C.1.

Marshalling Yard Equipment

Electrical equipment for the railway wagon marshalling system being supplied by Strachan & Henshaw, Ltd., Bristol, for the new steelworks of Richard Thomas & Baldwins, Ltd., at Llanwern, Newport, has been ordered from Mawdsley's, Ltd. The equipment includes 40 b.h.p. motors for operating the Strachan & Henshaw patented "Beetles," which move selected wagons or rakes of wagons used in the handling of coke and concentrates, coal, home ore and foreign ores, and the 200 b.h.p. Ward-Leonard variable speed control for the wagon tipplers.

Berry's Electric Catalogues

Berry's Electric, Ltd., are setting up a new department for the provision of sales literature. The new section, which will be managed by Mrs. E. M. Manning, opens on 1st August, and is at the company's works at Second Way, Exhibition Grounds, Wembley Hill, Middlesex (telephone: Wembley 3201).

Steel Mill Contracts

Contracts for rolling mill drives valued at nearly £500,000 and totalling 14,000 h.p. have been obtained from steel companies by the Heavy Plant Division of Associated Electrical Industries, Ltd. Motors accounting for half this horse-power will be installed in the Stocksbridge (Sheffield) works of Samuel Fox & Co., Ltd. The other orders are from the Head Wrightson Machine Co., Ltd., and the South Durham Steel & Iron Co., Ltd. Samuel Fox & Co. have ordered a 5,000 h.p. d.c. motor, auxiliary motors and control equipment for a new 40in hot reversing mill, the main drive for which will be supplied from a mercury-arc installation, and a 2,000 h.p. motor and control equipment for a 27in retractable mill. The order from the Head Wrightson Machine Co., on behalf of Tubes, Ltd., is for the main drive, consisting of two 2,000 h.p. motors, for a piercer and Assel elongator in the seamless tube mill at Kirby Muxloe, near Leicester. The South Durham Steel & Iron Co. has ordered a 3,000 h.p. d.c. drive for the finishing stand of a new universal beam mill.

Nuclear Safety Committee

Among the members of a committee appointed by the Government to advise them on questions relating to safety in nuclear developments are the following:—Sir Alexander Fleck (chairman), Dr. T. E. Allibone (A.E.I.), Sir John Cockcroft (Master of Churchill College, Cambridge), Professor P. I. Dee (University of Glasgow), Mr. T. F. Fletcher (Atomic Energy Authority), Sir Willis Jackson (President, I.E.E.), Professor J. M. Kay (Imperial College), Col. G. W. Raby (Atomic Power Constructions, Ltd.) and Mr. L. Rotherham (Central Electricity Generating Board).

Inquiry into Scottish Fire Disaster

The use of fluorescent lighting in bonded warehouses was criticised by Divisional Officer J. S. Evans, fire prevention officer, Glasgow, when he gave evidence on 28th June at an inquiry into a fire in a bonded warehouse in Cheapside Street, Anderston, Glasgow, in which fourteen firemen and five salvage men lost their lives. He said there was very little of anything that could be obtained from the debris that could give any clue to the origin of the fire. He had spoken to several witnesses and, theorising, there was only one factor that could have created a fire. There was no ignition source in the building other than the lighting which was installed. "I was shocked to find that fluorescent lighting should be used in a bonded warehouse," he said.

Mr. W. McNab, depute fiscal, who led the evidence, asked why fluorescent lighting should provide a source of ignition. Mr. Evans replied that "inflammable vapour would have access because there was no protection of the electric element." He agreed that it was impossible to say that that did cause the fire.

Detective-Superintendent J. McLellan, of the Glasgow Police Identification Bureau, giving evidence on the final day, said he thought there were only two probable causes of the fire meriting serious consideration—some accident due to an employee being careless, or an electrical fault. On the question of the fluorescent lighting fittings being liable to cause fire in the presence of highly inflammable vapours, he said, "My own feeling, and the opinion of persons I consulted, is that it was extremely unlikely."

The jury, returning a formal verdict, recommended that automatic fire systems should be fitted in all bonded warehouses used for storing alcohol.

West African Company

Impectron, Ltd., 303-306, High Holborn, London, W.C.1, informs us that it is forming a subsidiary company in West Africa, Impectron (Ghana), Ltd. The company, which will have its headquarters in Accra, will cover both Ghana and Nigeria and will specialise in the importation and distribution of electrical contracting material, machinery and appliances.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £252 10s 0d
Fire Refined 99·70%	ton £251 0s 0d
Fire Refined 99·50%	ton £250 0s 0d
COPPER Tubes	lb 2s 5¾d
Sheet	ton £286 15s 0d
H.C. wire and strip ..	ton £306 5s 0d
LEAD, English ..	ton £71 5s 0d
Foreign	ton £70 0s 0d
MERCURY	flask £70 10s 0d
TIN, block (English) ..	ton £805 0s 0d
ZINC, G.O.B. Foreign	ton £90 5s 0d
BRASS Tubes (solid drawn)	lb 2s 0⅝d
Wire	lb 2s 10⅜d
PHOSPHOR BRONZE Wire	lb 4s 3¾d
PLATINUM	oz £30 5s 0d
RUBBER, No. 1 R.S.S. spot	lb 34¼d—34¾d

Refrigerator Price Reduction

The General Electric Co., Ltd., announces that as from 1st July the price of its "Fabulous Four" (4 cu ft) refrigerator has been reduced from £72 16s 3d (including £10 18s 11d purchase tax and £2 installation and service charge) to £66 3s (including £9 18s 4d purchase tax and £2 service and installation charge).

Fluorescent Tube Manufacture

In the article entitled "Fluorescent Tube Manufacture" in our issue of 22nd April it was stated that the group of machines could be run with only six operators. The manufacturers have drawn our attention to the fact that this refers to the actual *assembly* line only and does not include tube washing or coating or the manufacture of the mounted stem. These operations are, of course, carried out on separate lines which meet at the beginning of the actual assembly line.

Domestic Refrigerator Sales

Both home and export sales of domestic refrigerators were well up again in May, according to the figures issued this week by the Domestic Refrigeration Development Committee. Sales of British-made domestic refrigerators on the home market totalled 137,279, compared with 125,881 in May, 1959, an increase of 9 per cent. This is the highest monthly total ever achieved by the industry and brings the total home sales for the five months January-May to 526,829. This compares with a total of 448,646 for the whole of 1958. Export sales were 76 per cent higher than in May, 1959.

Price Increase

Nalder Bros. & Thompson, Ltd., state that because of the rise in production costs as a result of the reduction of the working week in the engineering industry, they have had to increase their instrument prices by approximately 5 per cent and relay prices by 3½ per cent as from 1st July.

Trade Announcements

The address of **Oryx Electrical Laboratories, Ltd.,** is now Industrial Estate, Meadow Road, Worthing, Sussex (telephone: Worthing 30066).

The Limit Engineering Group, Ltd., have been appointed sole agents in the United Kingdom for inherent self-regulating alternators made by A. van Kaick, of Frankfurt.

Edmundsons Electrical Wholesalers, Ltd., have moved their Exeter depot to 17-25, Hoopern Street. The telephone number is unchanged (Exeter 58321).

Crofts (Engineers), Ltd., have opened a branch at Great Lister Street, Birmingham, 7. The premises include a showroom and reception and service counters, stores, garage and loading bays, administrative offices and staff canteen.

Change of Address

On 29th July the G.E.C. Applied Electronics Laboratories at Brown's Lane, Coventry, will be transferred to The Airport, Portsmouth, Hants (telephone: Portsmouth 62271).

Domestic Supplement – Electric Fires – at the end of this issue

PERSONAL AND SOCIAL

News of Men and Women of the Industry

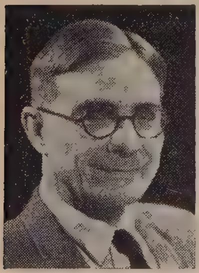
Mr. E. C. Rippon, M.I.E.E., formerly chief transformer engineer with C. A. Parsons & Co., Ltd., has been appointed to assist the managing director in matters relating to the organisation of design and production throughout the works. Mr. Rippon has also been appointed consultant to the Transformer Division. **Mr. Robert Bruce,** M.Sc., M.I.E.E., A.M.I.Mech.E., who has held the position of deputy chief transformer engineer for a number of years, has been appointed chief transformer engineer.

Mr. E. C. Rippon

Mr. R. Bruce

Mr. A. Stephens has rejoined Honeywell Controls, Ltd., as senior flow engineer at the company's Greenford (Middlesex) head office. **Mr. R. W. H. Vivian** has been appointed at the head office to specialise on application engineering using the company's electric miniature instrumentation, which is being introduced this year in the United Kingdom. Mr. Vivian will shortly leave this country for a brief study of United States experience in this field.

Mr. N. A. de Bruyne, M.A., Ph.D., F.Inst.P., F.R.Ae.S., is resigning from the position of managing director of CIBA (A.R.L.), Ltd., at the end of the year in order to devote more time to research. He will, however, remain on the board. From 1st January, 1961, **Mr. R. F. G. Lea,** O.B.E., M.A., will become deputy chairman of the company and he and **Mr. D. A. Hubbard** will also be joint managing directors.


Dr. N. A. de Bruyne

Mr. R. F. G. Lea

Mr. D. A. Hubbard

Mr. Claude E. Wallis retired from the board of Electrical Review Publications, Ltd., on 30th June. Mr. Wallis was also chairman and managing director of Associated Iliffe Press and a well-known figure in the motor industry.

Mr. R. A. Joseph, B.Sc., M.I.E.E., managing director, Midland Electric Installation Co., Ltd., is a member of the working party which the Minister of Labour has appointed to review the facilities provided in the workshops for the blind, and to recommend what changes may be needed to enable them to fulfil their role efficiently and economically under modern conditions.

On 21st June Mr. J. W. Garton, J.P., chairman and managing director of the **Hoffmann Manufacturing Co., Ltd.,** presented gifts to 47 men who had completed 40 years' service, and to seven women with 35 years' service.

R. W. Gregory & Partners, consulting engineers, announce that they have taken into partnership **Mr. G. P. Cundall,** B.Sc., A.M.I.E.E., as from 1st July. Mr. Cundall was educated at Bootham School, York, and Leeds University, and received his practical training with the Metropolitan-Vickers Electrical Co., Ltd., the B.T.H. Co. and British Insulated Callender's Cables, Ltd. Following a period with B.I.C.C. as contracts engineer in London, he was appointed sales engineer at their Newcastle office. He was chairman of the North-Eastern Students Section of the I.E.E. for the 1950-51 session and received a Students' Premium for his paper entitled "The Development of Power Cables." He has contributed articles to the technical Press. He joined the staff of R. W. Gregory & Partners as a senior electrical engineer in 1955.

Mr. G. P. Cundall

Mr. D. H. Rees has been appointed district manager, A.E.I.-Hotpoint, Ltd., Nottingham, in succession to **Mr. W. A. Hastings,** who has left the company to set up his own business. Mr. Rees joined Hotpoint in 1956 as a sales representative in Cardiff following service as a sales engineer with the G.E.C. and since last January has been sales supervisor, London district.

The A.E.I. Electronic Apparatus Division announces the appointment of **Dr. J. M. Westhead** as manager, Valve and Semiconductor Sales Department, Lincoln, in succession to **Mr. F. Baxendale,** who remains as consultant. Dr. Westhead studied at Oxford University where in 1952 he gained his doctorate (nuclear physics) while holding the position of university demonstrator in electronics. He joined the B.T.H. Electronics Sales Department (now A.E.I. Electronic Apparatus Division) in 1956 and was appointed assistant manager, Valve and Semiconductor Sales Department, Lincoln, in 1958, becoming deputy manager last April.

Dr. J. M. Westhead

Mr. C. Brayson has been appointed works manager of B. & R. Relays, Ltd. He has been production controller to the company for the past four years.

Dr. Peter Fortescue has been appointed chief research and development engineer of the newly organised General Atomic Europe. Dr. Fortescue, who is chief research and development engineer of the General Atomic Division of General Dynamics Corporation, in San Diego, California, will also continue to act in that capacity. He was formerly a deputy chief scientist at the U.K. Atomic Energy Establishment at Harwell and joined General Atomic in 1957, serving as senior member of the team responsible for the high temperature, gas-cooled reactor concept (H.T.G.R.). Earlier, while at the British Atomic Energy Establishment, he made major contributions to the development and construction of the Calder Hall power reactors.

Dr. Fortescue will be on assignment to General Atomic Europe's initial headquarters in Zurich, Switzerland, where he will be in charge of a group working on the development of a high temperature, gas-cooled power reactor in the 100 MW range suited to the requirements of European electric power generating systems. At the same time he will continue to play a leading role in the work at General Atomic in San Diego on high temperature gas-cooled reactor systems.

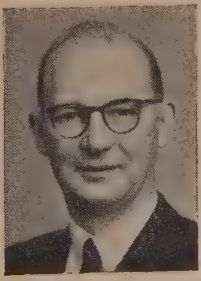
Mr. C. C. Bleach, Wh.Ex., M.I.Mech.E., M.I.E.E., who joined the Concordia Electric Safety Lamp Co., Ltd., in 1936 as general manager and later became managing director of the company and associated concerns, retired last week. He has been elected president of the South Wales Institute of Engineers for 1960-61 and is a past-president of the Association of Mining Electrical and Mechanical Engineers.

Mr. R. H. Lancaster, M.S.M.A., has been appointed marketing sales manager, United Kingdom, of the Merseyside Engineering (Refrigeration), Ltd., with special responsibility for the sales of "Everest" products in London, the Midlands and the south. Mr. Lancaster was formerly sales manager for Vactric, Ltd.

The guest speaker at last week's luncheon of the **Batti-Wallahs' Society** was Mr. G. Johnson Smith, M.P., who gave an interesting address on some of his Parliamentary impressions. The next luncheon of the Society will be held on 28th July.

Mr. J. C. Stewart has retired after twenty-two years as manager of the Glasgow branch office of George Ellison, Ltd. He is succeeded by **Mr. J. N. Smith,** B.Sc., A.M.I.E.E., who joined the company in 1952 after serving with the Belmos Co., Ltd., as a sales and contracts engineer in the Flameproof Switchgear Department.

Mr. J. C. Stewart



Mr. J. N. Smith

George Ellison, Ltd., also announce the transfer of **Mr. E. W. Brinkworth,** A.M.I.E.E., from the Leeds to the Birmingham branch office, from which he will operate as sales engineer for Ellison switchgear in the Nottingham area.

Mr. J. J. Gracie, C.B.E., M.I.E.E., a director of the General Electric Co., Ltd., and general manager of its Witton Engineering Works, is to retire at the end of the year at his own request, after thirty-four years' service with the company.

Mr. L. J. Roberts, B.Sc., who writes in this issue on "Sequence Control" (page 75), was educated at Monmouth School and graduated in electrical engineering at the University of Wales, Cardiff, in 1944. He served in the electrical branch of the Royal Navy from 1944 until 1947 when he joined the British Thomson-Houston Co., Ltd., as a student apprentice, entering the Industrial Engineering Department in 1949. He is now with the Industrial Application Engineering Department, Rugby, A.E.I. Motor and Control Gear Division.

Mr. L. J. Roberts

Mr. Robert W. Wait, A.M.I.E.E., has been appointed a director and general manager of M. & C. Switchgear, Ltd. Mr. Wait served his apprenticeship at the Sheffield works of Mavor & Coulson, Ltd., and held successive appointments as electrical service engineer, technical representative and chief electrical engineer and designer. He was president of the West of Scotland Branch of the Association of Mining Electrical and Mechanical Engineers for 1959-60.

Mr. R. W. Wait

Mr. A. S. Brack, who formerly held a senior position in the Glass-fibre Sales Department of Turner Brothers Asbestos Co., Ltd., Rochdale, has been appointed plastics representative for Northern England.

About 1,000 employees of **Oldham & Son, Ltd.,** Denton, Manchester, went in two special trains to Blackpool for the company's annual outing on 2nd July. After lunch Mr. John Oldham, O.B.E. (chairman), gave his customary review of the company's progress.

Measuring Instruments (Pullin), Ltd., have appointed **Mr. J. P. Minister** as general sales manager. Mr. Minister was previously London instrument manager of Sangamo Weston, Ltd. Mr. S. H. Hughes will continue as sales manager of the Instrument Division of M.I.P.

Mr. J. P. Minister

A gift of £2,000 has been made by Mr. G. H. Collins, of Malvern, to the **Electrical Industries Benevolent Association** through its Birmingham Branch. This follows a similar sum given by Mr. Collins five years ago on the occasion of the Association's golden jubilee.

Mr. R. F. Marshall, manager, Education Department, **A.E.I. (Manchester), Ltd.,** gave an address to apprentices at the Apprentice Association's parents' day at the Willesden Works of the Switchgear Division on 2nd July when he presented essay competition prizes to Messrs. C. L. Springford (special award), M. J. Webb, J. F. Hunt, A. S. Clark and R. J. King. The visitors were welcomed by Mr. H. Bush, works manager.

The Midlands Branch of the **Electrical Trades' Commercial Travellers' Association** held their annual treasure hunt around the Warwickshire lanes on 26th June. There was a good attendance and the results were as follows:—First, Mr. and Mrs. L. Cann; second, Mr. and Mrs. H. Smith; and third, Mr. and Mrs. G. Honnoraty.

OBITUARY

Mr. W. E. Affleck, M.I.E.E., manager of the Guildford District of the South Eastern Electricity Board, died on 28th June, two days before he was due to retire. Mr. Affleck, who was sixty-six, was born at Hawick, in Scotland, and served his apprenticeship with the Urban Electric Supply Co. there. He went to Guildford in 1920 as deputy engineer and manager and a year later, when Guildford Corporation acquired the electricity undertaking, he was appointed chief engineer and general manager at the age of twenty-seven. A memorial service was held last Friday at the Cathedral Church of the Holy Trinity, Guildford, followed by cremation.

Financial Section

STOCKS and SHARES

ALTHOUGH the volume of business has remained disappointingly low, apparently indicating that institutional investors are prepared to adopt a wait-and-see policy, the market has conspicuously refused to allow itself to be shaken by the recent tightening of the credit squeeze, and industrial prices have recovered to a higher level than that which ruled before these events. The view that we have now seen the worst, and that the next move can hardly fail to be in the reverse direction, has been widely canvassed, and appears to be given sufficient credence for many investors to be prepared to buy at current levels despite early uncertainties. The recovery in prices has been mainly confined to equities, however, and the gilt-edged market remains thoroughly out of favour. Both British Electricity 4½ per cent stock 1967–69 and the 3 per cent issue dated 1968–73, now yield a shade over 6 per cent if allowance is made for the prospective capital profit upon redemption, and it remains to be seen whether this merely represents another milestone in the long slide of Government stocks, or marks the final point of resistance.

Good Features

The combination of good figures and favourable press comments has assisted plastics shares, and both Bakelite at 59s and De La Rue at 80s 6d have established new peaks for the year. A similar distinction goes to Desoutter at 45s and to Ever Ready at 28s 3d, while useful gains have also been scored by International Computers & Tabulators at 66s 3d, Murex at 70s, Simon-Carves at 47s 6d, and Telephone Manufacturing at 9s 3d. The last-named jumped in response to an announcement that there might be a take-over by Pye, and shareholders would presumably be well advised to retain their holdings pending further information. It is hardly surprising that Richardsons Westgarth were further depressed to 8s 1½d by the chairman's warning that a reduction in the dividend for this year "must be regarded as likely." On the other hand, Head Wrightson, with a rise of 6d to 21s 3d, failed to make any substantial response to the chairman's cautiously hopeful report of increasing orders in the opening weeks of the current year.

Cambridge Instrument

Dividend policy of the Cambridge Instrument Company is to make quarterly distributions, a practice still as rare in this country as it is now common in America. This year's first two payments, of which the second has just been declared, make a total of 8 per cent gross and are approximately equal to last year's corresponding distributions, which were in tax-free

Price Changes in

Company or Board	Nom. Value	Middle price 4th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1960 Highest	1960 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	74	−½	3	3	4 1 0	79½	74
Brit. Elec. 1974/77	100	70½		3	3	4 5 0	76	70½
Brit. Elec. 1976/79	100	72½	−½	3½	3½	4 16 6	79½	72½
Brit. Elec. 1974/79	100	82½	−1	4¼	4¼	5 3 0	90½	82½
Brit. Elec. 1967/69	100	91½	+½	4½	4½	4 18 3	97½	91
Overseas Electric Supply								
Calcutta Elec.	£1	21/-		6·8†	7†	10 17 3	20/9	19/3
East African Power	£1	15/6		7½	8	10 6 3	20/3	15/6
Nigerian Elec.	£1	16/6		8	8	9 14 0	19/9	15/6
Perak Hydro-Elec.	£1	18/6	−1/-	10	5	5 8 0	19/-	15/3
Electrical Shares								
Aberdare Holdings	5/-	14/9	+3d	17½	17½	5 18 6	19/-	14/6
Aerialite	1/-	8/3	−3d	54	54	6 11 0	9/6	7/6
Allen, W. H.	£1	53/9	−1/3	12	14	5 4 3	60/-	51/3
Allied Insulators	5/-	19/4½	−7½d	—	20	5 3 3	23/3	19/4½
Anglo-Portuguese Tel.	£1	25/3	−1/-	9	9	7 2 6	29/-	25/3
Arcolectric	1/-	4/3		—	15	3 10 6	5/6	4/-
Aron Elec. Ord.	£1	74/6	−1/6	15	15	4 0 6	77/6	47/-
Assoc. Elec. Ind. Ord.	£1	52/6	−1/3	15	15	5 14 3	66/6	50/6
Automatic Tel. & El.	5/-	16/-	+7½	17	17	5 6 3	21/9	15/4½
Babcock & Wilcox	£1	36/3		13	9	4 19 3	48/9	33/6
Bakelite	10/-	59/-	+2/9	15	17½	2 19 3	59/-	40/-
Baldwin, H. J.	2/-	1/9	−3d	20	—	—	2/6	1/9
Berry's Electric	5/-	36/6	+3d	10	20‡*	2 14 9	38/-	29/6
Bowthorpe Holdings	2/-	7/10½	+1½d	27	18½*	4 14 0	11/6	7/9
Brit. Elec. Traction:								
Def. Ord. "A"	5/-	44/6	+1/-	35	40	4 10 0	49/3	42/-
B.I. Callender's	£1	51/3	+9d	13½	13½	5 5 6	61/-	50/-
B.I. Callender's 6% Pref. ...	£1	18/6	−1/6	6	6	6 9 9	21/-	18/6
British Thermostat	5/-	23/9		35	20*	4 4 3	26/-	21/3
Brook Motors	10/-	44/6	−1/3	25	25*	4 16 3*	53/6	44/6
Bulgin, A. F.	1/-	9/4½	−1½d	50	55	3 18 0*	10/3	8/-
Bulpitts	5/-	17/-	−6d	15	16¼	4 15 6	23/3	17/-
Burco Dean	5/-	9/10½	−1½d	16	18	—	15/9	9/10½
Cable & Wireless	5/-	15/9	+6d	10	10*‡	3 3 6	18/3	14/3
Chloride El. Storage "A" ...	£1	75/-	+1/3	20	17½*	4 13 3	75/9	65/6
Clarke Chapman	£1	48/9		13¾	13¾	5 12 9	63/9	48/9
Cole, E. K....	5/-	21/10½	+7½	20	22½	5 3 0	31/9	21/3
Contactor Switchgear	5/-	15/6	−9d	14	14	4 10 3	17/9	15/6
Cossor, A. C.	5/-	7/-	+3d	Nil	5	3 11 6	10/-	6/9
Crabtree	10/-	24/-		20	22½‡	4 13 9*	28/3	24/-
Crompton Parkinson	5/-	12/-	−6d	12	14	4 13 3*	15/-	11/9
Davis & Timmins	5/-	23/-		20	25	4 7 0*	23/-	17/-
De La Rue	10/-	80/6	+6/-	20	22½	2 16 0	80/6	62/-
Decca "A"	10/-	45/-		50	20*	4 9 0	51/3	42/-
Desoutter	5/-	45/-	+2/-	21⅜	30	3 6 9	45/-	37/6
Dewhurst	2/-	7/6		20	20	5 6 9	8/6	7/6
Dictograph Tel.	2/-	8/6		20	20	4 14 3	9/9	8/6
Dimplex	5/-	31/10½	+1½d	—	25‡	3 18 6	32/6	26/9
Dubilier Condenser	1/-	5/9	+3d	20	25	4 7 0	6/-	5/-
Duport	5/-	23/9		12½	17½	3 13 9	30/3	22/-
E.M.I.	10/-	50/6	+6d	20	14*‡	2 15 6	58/9	45/-
Electrical Apparatus	5/-	16/6		14½	14½	4 8 0	16/6	12/9
Electrical Components	5/-	9/6	−3d	12½	15	5 5 3*	13/9	9/6
Elec. Construction	£1	33/9	−1/3	9	9	5 6 9	43/-	33/9
Elliott-Automation	5/-	24/6	−6d	—	9·3*	1 18 0	26/-	19/9
Enfield Rolling Mills	£1	55/-	+1/-	15	15	5 9 0	56/3	48/-
English Electric	£1	38/3	+1/-	14	10*	5 4 6	53/-	36/3
English Electric 3¾% Pref. ...	£1	11/-		3¾	3¾	6 16 3	13/-	11/-
Ericsson Tel.	5/-	22/6		13†	13†	4 14 3	28/6	22/6
Ever Ready	5/-	28/3	+1/3	27½	20*	3 10 9	28/3	23/-
Falk Stadelmann	£1	31/6		10	10	6 7 0	35/9	31/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

form. For the whole of 1959 shareholders received the equivalent of a fraction over 20 per cent gross, covered rather less than twice by a net surplus of £259,000. They were told in the annual report that in the light of business conditions in the first part of this year they could reasonably expect that rate at least to be maintained.

Advance Components

Introduced to the market towards the end of last year, the 5s ordinary shares of Advance Components, manufacturers of constant voltage apparatus and electronic instruments, now change hands occasionally at around 15s. This year's annual report showed a considerable improvement in net profits to £23,000 after tax. The surplus comfortably covers a dividend of 15 per cent on the £100,000 capital, on which basis the shares provide a yield of 5 per cent. The company is using part of its resources to extend the factory and has also entered into agreements for manufacturing under licence certain instruments already proved by foreign makers, a procedure which avoids heavy research expenditure. The chairman spoke well of prospects in the present year.

Bonochord

The Bonochord company, whose 2s shares also came to the market in the later part of last year, may be expected to publish within a few weeks the first financial results since that event. Concerned originally with hearing aids and similar apparatus, the company was said in the advertised particulars to have widened its range of interests considerably through the development of instruments in the electronics field. Profits were shown to have been expanded over the course of recent years, and were expected to work out in the region of £25,000 (before tax) for the twelve months ended last March. A dividend at the annual rate of 10 per cent was indicated. This would be covered some 2½ times over by earnings at the level estimated, and would produce a yield of 8 per cent on the shares at the recent price of about 2s 6d.

Atlas Trust

The great advance of the unit trust movement seems to have been a factor in raising interest in the stocks of the older established investment trusts, many of which give the investor an opportunity of spreading small amounts of capital over a great range of industry and commerce and can show records of remarkably successful growth. Among the latest of them to publish financial results, the Atlas Electric & General includes in its report a table which records increases in income, and in the amount of the dividends distributed, in every one of the past thirteen years. At the end of March the trust held investments (mostly ordinary shares) having a market value of over £28 million. Part of the appreciation on their book value has now been capitalised in the form of a 100 per cent scrip issue. Quoted now in 5s units, at a price of 11s 6d, the shares show a yield of 3¼ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 4th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %			1960 Highest	1960 Lowest
Electrical Shares—continued						£	s	d		
G.E.C.	£1	35/3		10	10	5	13	6	47/6	35/3
G.E.C. 6½% Pref.	£1	20/6		6½	6½	6	6	9	22/3	20/6
General Cables	5/-	5/9		15	Nil		—		10/-	5/9
Goblin (B.V.C.)	5/-	8/9	+9d	7½	12½	7	3	0	13/9	8/-
Hackbridge Holdings	5/-	14/3	−1/-	20	20	7	0	3	17/3	14/3
Hackbridge & Hewittic	5/-	14/6		20	20	5	3	6*	15/-	13/-
Head Wrightson	5/-	21/3	+6d	20	14*	3	5	9	31/6	20/9
Heatrae	2/-	11/-		20	22½	4	1	9	12/3	8/9
Holophane	5/-	17/6	+6d	22½	26	7	8	6	20/6	17/-
Hoover	5/-	45/-	−1/-	60	90	5	0	0*	55/-	45/-
Intl. Combustion	5/-	27/9		30	30	5	8	0	46/9	26/6
Intl. Computers & T. ...	£1	66/3	+2/6	—	10	3	0	3	78/6	61/6
Johnson & Phillips	£1	20/3	+3d	5	Nil		—		24/-	19/6
Laurence Scott	5/-	19/9		15	15*	3	16	0	25/3	18/-
Lister, R. A.	£1	54/-		12½	14	5	3	9	62/-	52/6
Lucas, J.	£1	70/-	+1/3	10	12½	3	11	6	74/6	65/-
Marryat & Scott	2/-	13/9	−1/3	37½	22½*	3	5	6	16/9	14/3
Mather & Platt	£1	46/3		10⅝	11	4	15	3	59/-	46/3
Metal Industries	£1	65/6	+1/6	14	15‡	4	11	6	76/3	61/3
Midland Elec. Mfg.	£1	57/6		10	12	4	3	3	58/9	53/6
Morphy-Richards	4/-	21/9		20	25	2	6	0*	23/6	16/3
Murex	£1	70/-	+3/9	17½	15	4	5	9	77/-	62/6
Newman Ind.	2/-	4/9	−3d	10	12½	5	5	3	5/3	4/-
Oldham & Son	1/-	3/1½	+1½d	17½	17½	5	12	0	3/3	2/9
Parsons, C. A.	£1	51/9	+6d	8⅛	9⅜	3	12	6	59/-	46/-
Philips' Lamps	Fl.10	232/6	−2/6	13·3	16	1	7	3	£12¼	137/-
Plessey	10/-	49/6	−6d	20	14*‡	2	16	6	54/6	44/3
Pye	5/-	16/9	+1/-	12½	15	4	9	6	19/-	14/9
Pyrotenax	5/-	53/6	+1/6	—	34	3	3	6	56/-	44/3
Radiation	£1	34/4½	+1½d	6	12	7	0	0	44/6	34/3
Reliance Clifton	5/-	24/-	+6d	15	15	3	2	6	28/-	22/-
Reyrolle	£1	39/-	−3d	17½	17½	4	9	9*	52/3	38/-
Rheostatic	4/-	15/9	−3d	20	18¾*‡	4	15	3	17/-	12/6
Richardsons Westgarth	10/-	8/1½	−1/7½	8⅓	8⅓	10	5	0	14/9	9/9
Sangamo Weston	10/-	20/9	−3d	12½	11*	5	6	0	22/9	19/3
Simon-Carves	5/-	47/6	+3/-	25	35		—		54/-	36/-
Smith (England), S.	4/-	17/3	+3d	12½	17½	4	1	0	20/-	16/-
Southern Areas	£1	15/-		Nil	5	6	13	3	15/6	13/-
Strand Elec.	5/-	16/9	+6d	15	20	5	19	6	20/3	15/9
Sturtevant	5/-	15/-		15†	15†	8	4	0	24/3	15/-
Sun Elec.	5/-	15/9		25	15*	4	15	3	16/3	15/-
Switchgear & Cowans	5/-	15/6	−6d	15	17½	5	13	0	18/9	15/6
T.C.C.	10/-	46/3		25	35	5	1	0*	48/3	37/3
Telephone Mfg.	5/-	9/3	+3/3	10	5	2	14	0	9/3	5/-
Telephone Rentals	5/-	21/3	+6d	12½	15*	3	10	6	21/3	17/-
Thompson (John)	5/-	17/3	+3d	25	20	5	16	0	25/9	17/-
Thorn Elec.	5/-	50/-	+1/3	17½	20	2	0	0	55/6	44/3
Thorneycroft	£1	23/9	−1/-	7½	6	5	1	0	31/-	23/-
Tube Investments...	£1	77/6	+2/6	20	13‡	3	7	0	95/6	65/3
Vactric	5/-	26/3	+1/3	25	37½	7	3	0	43/9	25/-
Walsall Conduits	4/-	13/1½	−1½d	22½	15*	4	11	6	16/-	13/1½
Ward & Goldstone	5/-	59/-	+1/-	30	35	2	19	3	60/-	51/3
Watford	2/-	11/-		25	25	4	11	0	17/6	11/-
Westinghouse	£1	49/-	+2/-	10	11	4	10	0	59/9	47/-
West, Allen	5/-	12/9	+3d	12½	12½*	4	18	0	17/-	12/6
Wilkins & Mitchell	5/-	19/9	+6d	15	17*	4	6	0	25/9	19/3
Wolf Electric	5/-	13/3	+3d	10	12½	4	14	3	13/3	10/9

REPORTS and DIVIDENDS

Richardsons, Westgarth & Co., Ltd.—Mr. O. J. Philipson, the chairman, says in his statement, to be presented at the annual meeting on 22nd July, that although some redundancy resulted in 1959-60 because the works capacity was not fully employed it was not so great as had been anticipated. Substantial expenditure has been incurred on technical developments and on projects not yet brought into use, although in respect of the first they had booked by the end of the year work totalling more than £2½ million which would otherwise not have been obtained. With regard to their main products—marine engines, large turbo-alternators and other power plant, and boilers—excess manufacturing capacity at home and abroad is having a depressing effect upon price levels and the future is further complicated by the advent of the European Common Market and the European Free Trade Area, the full consequences of which cannot yet be assessed.

Although it is expected that the works will be more active this year, with the present trend of costs and low price levels a further fall in profits would seem to be inevitable, with a consequent reduction in the dividend. In this respect, however, the board will continue to have regard to long-term considerations, including the state of the order book and the course of the large contracts which extend over several years.

Ward & Goldstone, Ltd.—The main figures in the accounts for the year to 31st March last were given in our issue of 24th June. In his circulated statement, Mr. S. Goldstone (chairman and managing director) says that the company has, during the year under review, increased, and by a wide margin, the overall volume of output from its several factories. Earnings on an appreciably enhanced turnover have been rather more than maintained, in spite of narrowing margins and most serious competition in certain spheres of its many activities. At the conclusion of the war the company occupied two factories with a total area of approximately 150,000 sq ft. Today, it operates twelve factories in the Lancashire area alone with a total floor space of over 1,500,000 sq ft. Thus, physically, the company is ten times as large as it was fifteen years ago. Dealing with the cable division, he says that its profitability has been sorely impaired by the debasement of selling prices, consequent upon the incomprehensible practices of certain leading manufacturers, who have either deliberately, or by lack of knowledge, set a price standard below the costs of production. Such arrant folly is dangerously detrimental to all facets of the industry and while there is, at least, some evidence of a change, its injurious effects will, unfortunately, remain for some time.

They are not a little concerned at the unrestricted importation of "Empire" made electrical accessories produced in the Far East, where labour rates are commensurate with the lower living standards of the workers in those areas; this imposes an unfair handicap on all those employed in the industry and unless a corrective duty is applied, as is practised in some of the Dominion markets, the influence on employment, as well as profits, might well be serious.

Heatrae, Ltd.—In his statement circulated with the report and accounts for 1959-60, Mr. A. H. Freeman (chairman) says that the year's turnover reached a record figure. The company's designers and engineers have been actively engaged in redesigning established products and developing new ones. Competition in the domestic market both at home and abroad is very keen, especially in regard to water heaters and space heating appliances, but the company has improved its position in this field and its "Lido Express" water heater has established itself as a market leader. The chairman also states that the output of technical products is expanding at a brisk rate.

Ultra Electric (Holdings), Ltd.—The 1959-60 results were reported in our issue of 24th June. In the course of his statement to be presented at the annual meeting on 14th July, the chairman, Mr. E. E. Rosen, says that further steps have been taken to diversify the company's electronic interests; he refers particularly to aircraft electronics, anti-submarine defence and air/sea rescue equipment. Orders in hand at the end of the year were about the same as a year earlier and he expects the new developments to find an ever-growing market.

British Thermostat Co., Ltd.—The annual meeting was held on 2nd July, Mr. J. E. Sherlock (chairman and managing director) presiding. In his circulated statement, the chairman said that the reduction in profitability of the aircraft business which he forecast both a year ago and when the interim dividend was announced, had not been so severe as he had expected and the subsidiary companies which operated at Sunbury, although hampered by lack of space, had increased considerably the amount of their business and profits. The second half of the year in fact was better than the first. Dealing with future prospects, the chairman said that the order books of all British subsidiaries stood at a high level and unless there was a major national or international crisis he saw no other reason to forecast a decline in profitability.

Metal Industries - Lancashire Dynamo Merger.—Metal Industries, Ltd., announces that it has now acquired the outstanding balances of ordinary and 5½ per cent cumulative preference stock in Lancashire Dynamo Holdings, Ltd., in respect of which acceptances were not received from the holders. On completion of this transaction, and following the recent rights issue, the issued capital of Metal Industries, Ltd., now stands as follows:—5 per cent cumulative preference stock, £1,212,000; 3¾ per cent cumulative preference stock, £1,560,000; ordinary stock (ranking for final dividend for the year to 31st March, 1960), £4,140,338; new ordinary stock (not so ranking), £3,334,785; a total of £10,247,123.

Instrument Companies to Merge.—Last week Dr. P. Dunsheath, chairman of the Cambridge Instrument Co., Ltd., announced an offer by his company for the whole of the ordinary share capital of the 15-year-old firm of Electronic Instruments, Ltd. The offer is on a share exchange basis of seven Cambridge 5s shares for three £1 Electronic Instruments' shares.

At the current London Stock Exchange quotation for the Cambridge 5s shares of 25s 6d, the E.I.L. shares total approximately £550,370 for the 185,000 E.I.L. issued ordinary shares. An extraordinary general meeting of the Cambridge Instrument Co., Ltd., will be called in the near future to increase the nominal capital from £1,500,000 to £1,650,000, by the creation of 600,000 new ordinary shares of 5s. The directors of Electronic Instruments, Ltd., recommend the acceptance by their shareholders.

This merger is stated to have been mutually sought and "enables the two firms to co-ordinate their complementary research, development, production and market resources, thus creating a more powerful organisation to meet the rapidly changing conditions and requirements of the home and overseas markets."

It is intended that Electronic Instruments, Ltd., will operate under its own name and that Mr. A. C. W. Norman will continue as chairman, Mr. P. Goudime as managing director, and Mr. D. A. Pitman as sales director, joined by three Cambridge directors. Subject to acceptance of the offer, Mr. Goudime will be invited to join the board of the Cambridge Instrument Co., Ltd.

Telephone Manufacturing Co., Ltd.—A further development in the bid for the control of this company was reported on Tuesday last. Following the earlier announcement by the board of T.M.C. that Pye, Ltd., was to make an offer for the £900,000 capital of the company, a consortium of seven telephone and electrical manufacturers is making an offer. The members of the consortium are: Associated Electrical Industries, Ltd., Automatic Telephone & Electric Co., Ltd., Ericsson Telephones, Ltd., General Electric Co., Ltd., Marconi's Wireless Telegraph Co., Ltd., Plessey Co., Ltd., and Standard Telephones & Cables, Ltd.

The Pye offer is four Pye 5s ordinary units for every five 5s ordinary shares in T.M.C. and values the company at £2·43 million. The consortium is to make a cash offer of 12s 6d per share. The board of T.M.C. states that it is considering the offer and will make a further announcement as soon as possible. The consortium intends that the business of T.M.C. should be conducted as a separate entity, that its goodwill should be maintained, and that the interests of staff and workpeople should be fully safeguarded.

John Mowlem & Co., Ltd.—In his speech at the annual meeting of the company (which is associated with the G.E.C./Simon-Carves Group in the construction of the Hunterston nuclear power station) the chairman, Sir George Mowlem Burt, said that progress on the station was being well maintained. But, in common with most contractors engaged in this type of work, they were disappointed with the outcome to date and they had felt it unwise for the purpose of the 1959 accounts to anticipate receiving any profit. In view of the existing conditions they could not take any other than a somewhat pessimistic view of the financial position of the contract.

Simms Motor & Electronics Corporation, Ltd.—At the annual general meeting on 1st July Mr. G. E. Liardet (chairman and managing director) announced that the Simms group of companies had just completed negotiations to acquire, "for a sum in the region of a quarter of a million pounds," the whole of the issued share capital of Dawe Instruments, Ltd., Ealing, Middx., and their associated manufacturing company, L.M.K. Manufacturing Co., Ltd., Brentford. The board of Dawe Instruments is reconstituted and with the resignation of Messrs. E. C. Kent and A. D. Wells is now as follows:—Mr. G. E. Liardet (chairman), Mr. F. W. Dawe (managing director), Mr. J. Ayres, Mr. M. A. Hassid and Mr. K. G. Smith.

E. K. Cole, Ltd., are raising the dividend from 20 to 22½ per cent for 1959-60 by paying 15 per cent on capital increased by a one-for-three rights issue. Holders of the 7 per cent preferred ordinary shares are again to receive a 3 per cent participating dividend. There was a very slight fall—from £817,773 to £817,478—in the group profit, but with a lower tax charge the net profit rose from £403,873 to £417,928.

Johnson, Matthey & Co., Ltd., announce an increase in group profits from £1,455,909 to £1,925,299 for 1959-60 and in the net balance from £828,282 to £960,130. The 9 per cent final dividend maintains the total distribution at 12 per cent on a capital increased by 50 per cent.

Allied Ironfounders, Ltd., report a continuance of the improvement in sales in 1959-60. The net profit of the group rose from £720,878 to £1,355,576 and the dividend for the year was 20 per cent, against 12½ per cent.

Reliance-Clifton Cables & Industrial Products, Ltd.—At the annual meeting on 29th June, the chairman (Sir Robert Renwick) said that he thought the worst of the conditions in the electric cable industry had been weathered. If that proved so consideration would be given to an increase in the dividend which had been deferred.

Renold Chains, Ltd.—The group profit for the year to 3rd April last amounted to £1,824,248, as compared with £1,091,128 for the preceding year, and after providing £887,458 for United Kingdom and overseas taxation, and deducting minority interests of £9,981, the net balance is £926,809 (against £495,561), of which £128,141 is retained in subsidiaries. General reserves receive £300,000 and it is proposed to pay a final dividend of 8 per cent on capital increased by a 50 per cent scrip issue, making the equivalent of 10 per cent for the year (against 8·33 per cent). The balance carried forward in the accounts of the parent company is £142,068 (against £153,574 brought in).

Pyrotenax, Ltd., has declared a final dividend of 25 per cent, making 40 per cent, against 34 per cent for 1958-59 (which included a bonus of 4 per cent). The group trading profits rose to £808,133 from £740,276 and the balance after meeting taxation was £430,894, against £391,750.

Liquidations

Northern Electrical Servicing Co. (Darlington), Ltd.—Meetings 25th July at 6, Victoria Road, Darlington, to receive an account of the winding-up by the liquidator, Mr. A. Hopper.

Sigma Electrical Manufacturing Co., Ltd., electrical engineers, Sheepcote Street, Birmingham, 15.—Winding up voluntarily. Liquidator, Mr. W. E. Quance, York House, 38, Great Charles Street, Birmingham, 3, appointed 21st June. Particulars of claims to the liquidator by 15th July. This notice is purely formal; all known creditors have been or will be paid in full.

Ross-on-Wye Radio, Ltd., electrical, radio and television sales and service, 25, Broad Street, Ross-on-Wye, Herefordshire.—Winding up voluntarily. Liquidator, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3, appointed 16th June. Particulars of claims to the liquidator by 19th August.

S. & J. Electrical Appliances, Ltd.—Liquidator, Mr. T. J. Newman, Bank Chambers, 214, Bishopsgate, London, E.C.2, appointed 29th March.

Central Electrical Co. (Colchester), Ltd.—Meeting of members 29th July at 8, West Stockwell Street, Colchester, to receive an account of the winding-up by the liquidator, Mr. F. J. Eves.

Bankruptcies

J. Crampton, carrying on business as Grosvenor Electrics at 125, Frederick Street, Rotherham, Yorks.; formerly carrying on business at 97, Mary Street, Scunthorpe, Lincs., and previously in partnership with another as Grosvenor House Electrical Products at 147, Askern Road, Bentley, Doncaster, and at 125, Frederick Street, Rotherham, electrical retailers.—Receiving order made 24th June on debtor's petition.

V. L. Morgan (described in the petition as B. L. Morgan), electrician, "Woodlands," Bishopswood Road, Prestatyn, Flints.—Receiving order made 23rd June on a creditor's petition.

A. Banoff (trading as Almyn Radio Electric Co.), lately carrying on business at 111, Church Road, Hove, Sussex, electrical and radio engineer.—Supplemental dividend of 1⅛d in the £, payable at the Official Receiver's office, 8, Old Steine, Brighton, 1.

F. Jones and **B. P. Callaghan**, formerly trading in co-partnership at 2, Farm Yard, Levenshulme, Manchester, as Jones & Callaghan, electrical engineers and sheet metal workers. (Separate estate of B. P. Callaghan.)—First and final dividend of 20s in the £ payable at the Official Receiver's office, 20, Byrom Street, Manchester, 3.

Capital Expenditure on Railways

Questioned in the House of Commons last week about the effect on the railway modernisation programme of the Government's decision to maintain capital expenditure at existing levels, the Minister of Transport (Mr. Marples) said the programme of investment in the public sector for 1961-62 was now being reviewed, and it was not yet possible to forecast how different parts of the programme, such as railway investment, might be affected.

GENERATION AND DEVELOPMENT

Fuel and Power Co-ordination

In a letter to *The Guardian*, Mr. A. M. F. Palmer criticises the Minister of Power for the short-sighted policy which led first to a power programme relying largely upon nuclear energy and then to a slowing down of nuclear development. Mr. Palmer points out that under the Fuel and Power Act of 1945 the Minister is charged with the duty of bringing about the effective and co-ordinated development of fuel and power. This, he suggests, the Minister is not doing. If he feels that he is technically incapable of carrying through such a policy, then Parliament should be asked to consider the creation of a National Energy Commission to control, but not to own, primary energy sources (coal mines, oil imports, water supply and uranium processing plants) and license conversion agencies (conventional, nuclear and hydro power stations, gasworks, coke plants, oil refineries, etc.).

Opening of Blyth "A"

When he unveiled a plaque recording the official opening of Blyth "A" power station last week, Mr. J. C. Mitchell, former controller of the North Eastern Division, Central Electricity Generating Board, recalled that about nine years ago he and his colleagues spent a considerable time inspecting sites up and down the North-East for the new power station. Eventually, he said, they decided that Blyth would fulfil their needs. The "A" station would use 1,500,000 tons annually, and energy from the plant would be transmitted all over the North of England and into Scotland.

Mr. J. B. Jackson, who succeeded Mr. Mitchell as controller two years ago, said that the combined "A" and "B" power stations would cost £60 million. The "B" station, due to be completed in 1965, would have two 275 MW and two 350 MW generators. Those present at the ceremony included Mr. A. Robens, who becomes chairman of the National Coal Board next year.

Protest Against Refrigerator Scheme

In a revised plan by Dagenham Council for the sale of refrigerators to its tenants the prices quoted are said to be below the traders' fixed prices. The Council's explanation for this is that the refrigerators are being obtained at a bulk-purchasing price. On behalf of local traders, Mr. J. Wright has sent a letter of protest to the National Chamber of Trade pointing out that when they buy refrigerators they are required to sign a contract stating that they will not sell them below a certain price. If the Council wished to enter the business, it should be controlled by the same conditions.

Dounreay Exhibition for Tourists

The atomic energy reactor at Dounreay, Caithness, is now a tourist attraction. The holidaymakers who flock to John o' Groats, less than 30 miles away, are being encouraged by the Atomic Energy Authority to see the 140-acre nuclear project at first hand—if only from outside the security fence. An exhibition that overlooks the site and is the only one of its kind in Britain has been set up to give tourists an explanation of the experiments which scientists are carrying out in the reactors.

New Singapore Power Station

The Guardian reports that the Prime Minister of Singapore, Mr. Lee Kuan Yew, last Saturday opened the new St. James's power station in which the steam generating plant has been replaced by six 6 MW sets each consisting of eight GS-34 free piston gasifiers and a nine-stage axial-flow expansion turbine directly connected to a generator. The engines have been supplied by the Free Piston Engine Co., a member of the Associated British Engineering group. Another member of the group, British Polar Engines, Ltd., made the gasifiers and the turbines and alternators were supplied by the Cie Electro-Mécanique, the French licensee of Brown Boveri. The consulting engineers were Messrs. Preece, Cardew & Rider.

Nuclear Power Policy

The Minister of Power again came under fire from Opposition members in the House of Commons last week over the Government's latest nuclear power plans. Mr. Mason said the Minister's statement had been "a shocking indictment of Government planning." The Government had encouraged the rapid build-up of the industry; then they had disagreed with joining Euratom, virtually throwing the industry out of the export market; and then they had twice cut back the development of the industry. He asked why the Government had decided to curtail development in view of the fact that nuclear power generation for base load purposes was likely to become cheaper than conventional generation by 1970.

The Minister replied that the decision related only to the rate of ordering during the next few years. Nuclear power stations to come into operation in 1970 need not be ordered until about 1965 and the decision on the rate of ordering could be decided nearer the time.

Mr. Mason said the Government were purposely stultifying and discouraging the development of the industry, to which Mr. Wood replied, "I cannot for a moment accept that the long-term prospects of the industry would be improved if I suggested that it should build a great many uneconomic stations in the next few years."

Questioned about the industry's contribution to the export trade by Mr. Driberg, Mr. Wood said the demand for nuclear power overseas had been less than was expected. British companies had obtained export orders for two nuclear power stations and hoped to have the opportunity of tendering for others now in prospect. On the cost of nuclear power, he said that it had certainly been estimated that the break-even date would be rather nearer 1960 than now appeared likely. That was one of the reasons why it seemed wise to make the revision of the programme. Apart from the Atomic Energy Authority's stations at Calder Hall and Chapelcross, which produced electricity as a by-product, no nuclear power station had yet been completed in this country. It was still too early to say what the individual stations would cost, as the electricity authorities were still negotiating variable items with the contractors. For calculating depreciation, the life of these stations had been taken as 20 years, though it might be longer. When the stations reached the end of their useful lives they would be dismantled, except for the reactors which would be sealed up, and new stations might be built on the same sites.

Mr. Wood told Mr. Hamilton that the slowing down of the nuclear programme would not affect the National Coal Board's plans up to 1965. The effect on subsequent years would be taken into account when the National Coal Board and the electricity industry had discussed the latter's coal requirements.

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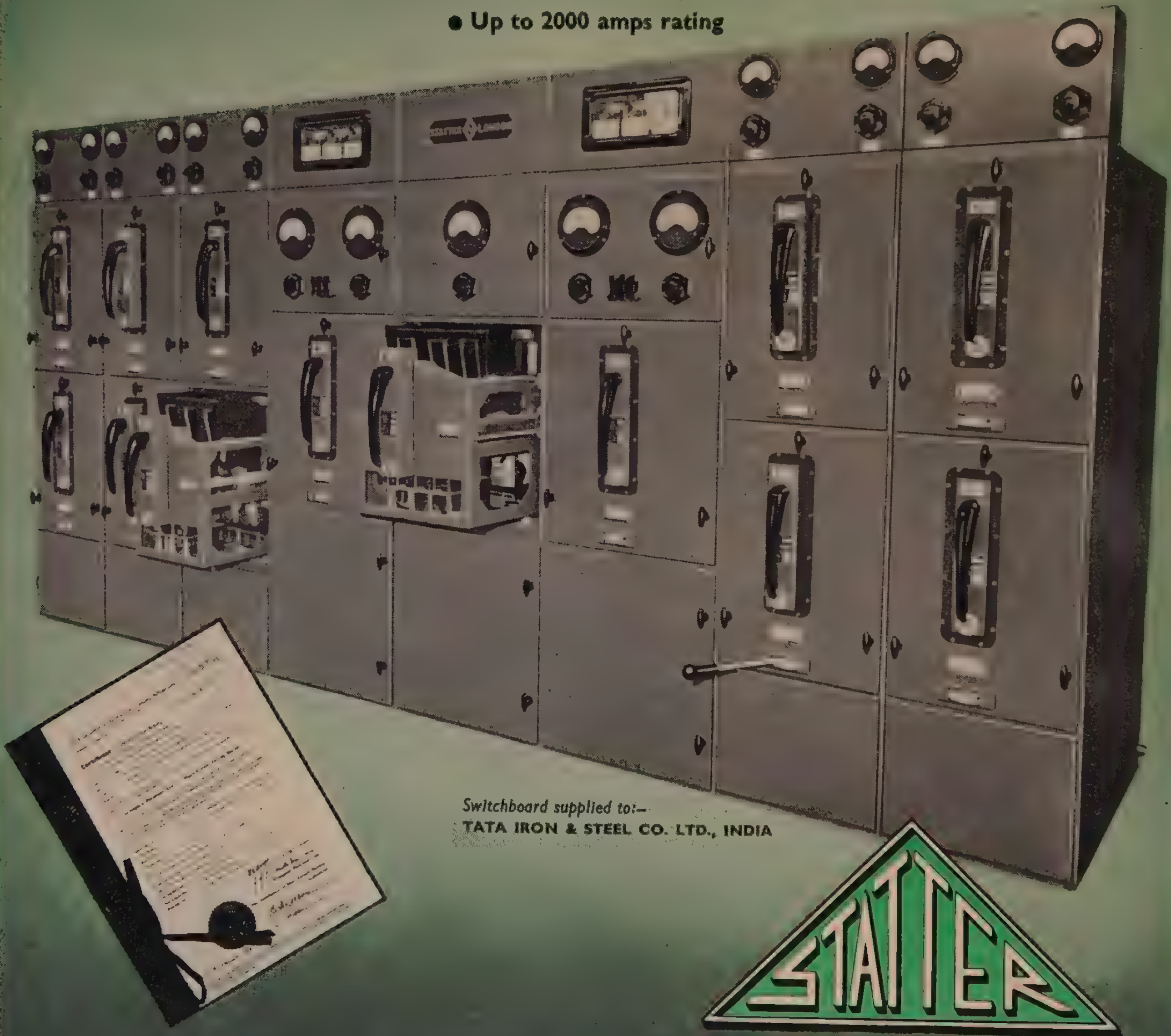

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Sequence Control

By L. J. ROBERTS, B.Sc.*

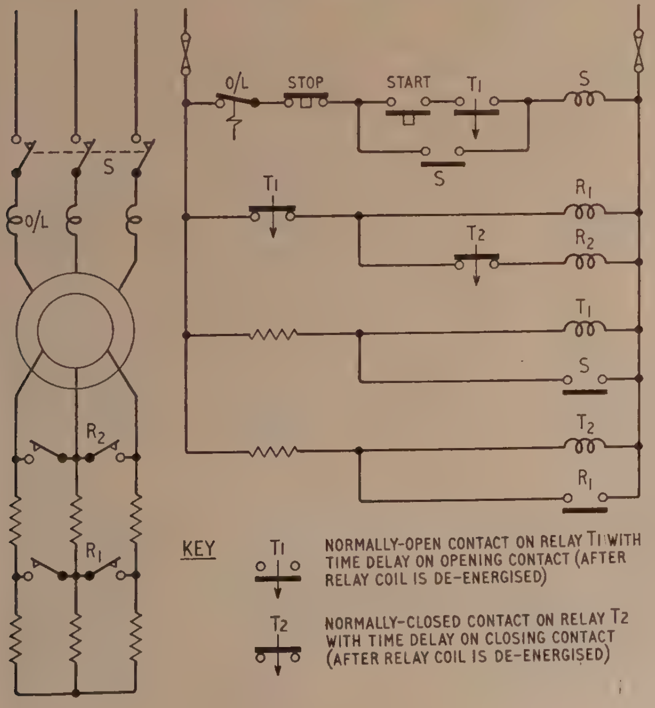
Some of the electrical techniques of successful sequence control are discussed and illustrated in detail. Examples of the applications to various production processes, factories and industries are also given, particular attention being directed to a tarmacadam production plant. The use of the Post Office uniselector switch is also cited

THERE can be few industrial processes or drives at the present time which do not employ some form of sequence control. This can be defined as the automatic control of a number of factory or like operations, particularly conveying or handling, in a certain predetermined order or in a sequence automatically governed by signals dependent on position, speed, time, current and so on, so that materials may be fed to the required section of the processing plant in the correct order.

An example of a simple form of sequence control is that of a motor starter of the automatic contactor type where the order in which the main contactors close is governed. In addition, an overriding control is usually provided, dependent on current, time or speed. This ensures that the contactors close at the correct time in the sequence. For example, it may be necessary to control the rate of acceleration in accordance with the requirements of the drive or in such a manner that the peak currents drawn from the line by the motor are within the stipulated limits of the supply.

The control circuits of a simple automatic starter for a slipring induction motor are shown in Fig. 1. This particular starter has a triple-pole stator contactor S and two double-pole rotor contactors R1 and R2. In the scheme shown, overriding time-limit control is used.

Fig. 1.—Typical sequence control scheme using s.r. induction motor starter


O/L
STOP
START
T1
S
S
O/L
S
T1
R1
T2
R2
T1
S
T2
R1
R2
R1
KEY
T1
NORMALLY-OPEN CONTACT ON RELAY T1 WITH TIME DELAY ON OPENING CONTACT (AFTER RELAY COIL IS DE-ENERGISED)
T2
NORMALLY-CLOSED CONTACT ON RELAY T2 WITH TIME DELAY ON CLOSING CONTACT (AFTER RELAY COIL IS DE-ENERGISED)

As soon as supply is available, timing relays T1 and T2 pick up and open their normally-closed contacts in series with the operating coils of rotor contactors R1 and R2 respectively. When the start button is operated, stator contactor S picks up and the motor is energised with the maximum amount of rotor resistance connected to limit the starting current to the value required and provide the necessary starting torque.

At the same time, a contact on S short-circuits the coil of timing relay T1. This relay is of the type fitted with a copper sleeve between the coil and the core. The eddy currents produced within this sleeve oppose the die-away of flux in the magnet system of the relay when its coil is short-circuited. As a result, a time delay is obtained before the relay contacts open. The delay is set so that the motor current has fallen to a reasonable value before relay T1 drops out.

When this occurs, its contact closes to energise the rotor contactor R1. The main contacts on R1 short-circuit a section of resistance in each rotor phase whilst an auxiliary contact R1 short-circuits the coil of timing relay T2. The motor continues to accelerate and, when the time delay of relay T2 has expired, it drops out of circuit and its contact closes. This completes the circuit to pick up the final rotor contactor R2 whose contacts short-circuit the remainder of the rotor resistance. The motor then accelerates to full speed.

Overriding control is sometimes derived from rotor current instead of time. In this system, relays are arranged to pick up when the rotor current exceeds a certain value and drop out of circuit when the current falls to a preset value. Operation of the rotor contactors is prevented until such time as their associated relays have dropped out of circuit and indicated that the rotor current has fallen to the required value.

Sequence control is very widely used in coal-handling systems, quarry plant, and throughout the wide range of applications where it is necessary to handle materials in bulk, with one section of plant fed from another and operated in sequence. In such applications, systems of conveyors are frequently used to carry material from one conveyor section to another and from one treatment plant to the next.

It is imperative that conveyor drives shall be sequence operated to ensure that they can be started up only in the correct order so that delivery of material on to a stationary belt is prevented. A system of interlocking often used to provide this protection is shown in Fig. 2.

From this it can be seen that the final conveyor in the system has to be started first. As soon as its motor con-

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* Heavy Plant Division, Associated Electrical Industries, Ltd.

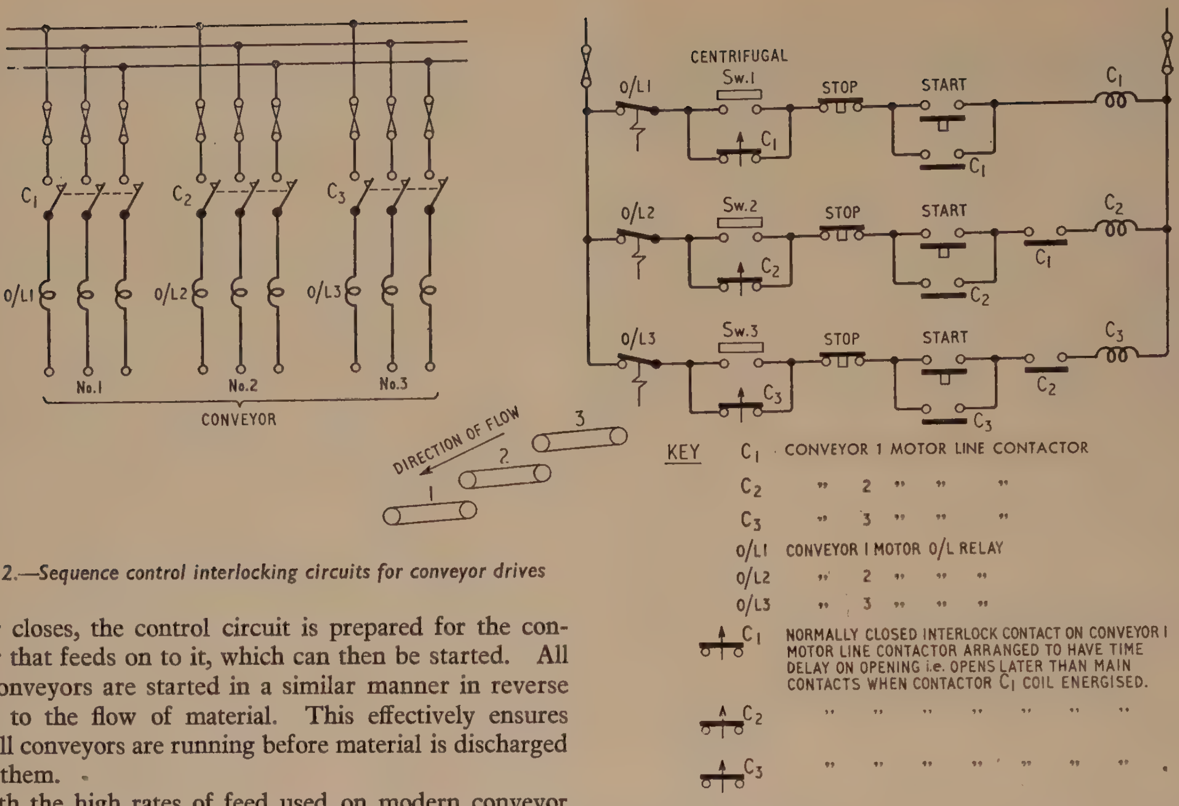

C1
C2
C3
O/L1
O/L2
O/L3
No.1
No.2
No.3
CONVEYOR
DIRECTION OF FLOW
1
2
3
CENTRIFUGAL
Sw.1
Sw.2
Sw.3
STOP
START
KEY
C1 CONVEYOR 1 MOTOR LINE CONTACTOR
C2 " 2 " " "
C3 " 3 " " "
O/L1 CONVEYOR 1 MOTOR O/L RELAY
O/L2 " 2 " " "
O/L3 " 3 " " "
C1 NORMALLY CLOSED INTERLOCK CONTACT ON CONVEYOR 1 MOTOR LINE CONTACTOR ARRANGED TO HAVE TIME DELAY ON OPENING i.e. OPENS LATER THAN MAIN CONTACTS WHEN CONTACTOR C1 COIL ENERGISED.
C2 " " " " " " "
C3 " " " " " " "

Fig. 2.—Sequence control interlocking circuits for conveyor drives

tactor closes, the control circuit is prepared for the conveyor that feeds on to it, which can then be started. All the conveyors are started in a similar manner in reverse order to the flow of material. This effectively ensures that all conveyors are running before material is discharged on to them.

With the high rates of feed used on modern conveyor systems, malfunction of a conveyor or belt breakage unnoticed for a short period of time can create a serious spillage of material.

The sequence interlocking system used during starting also provides the necessary protection should a conveyor shut down due, for example, to an overload on the drive. All conveyors feeding on to that conveyor will be stopped since their motor contactors will be tripped out in sequence. All conveyors beyond it in the system will be allowed to continue running and discharge the material being carried by them.

To minimise the danger from belt breakage, centrifugal switches are sometimes fitted. These are driven from the belt and are connected as shown in Fig. 2 so that they trip out the conveyor main contactor as soon as belt breakage is detected. The normal sequence interlocking then shuts down all the conveyors which feed on to it. Back-up protection can also be provided through the centrifugal switches. If the contacts of the switch do not close within a predetermined time after the control circuit has indicated that the drive has started, the conveyor is stopped.

It is sometimes necessary to be able to carry material along various alternative routes which involves the sequence operation of conveyors in different orders. Route-selection switches are often provided for the purpose whose contacts are arranged to modify the sequence interlocking to suit the various modes of operation of the plant.

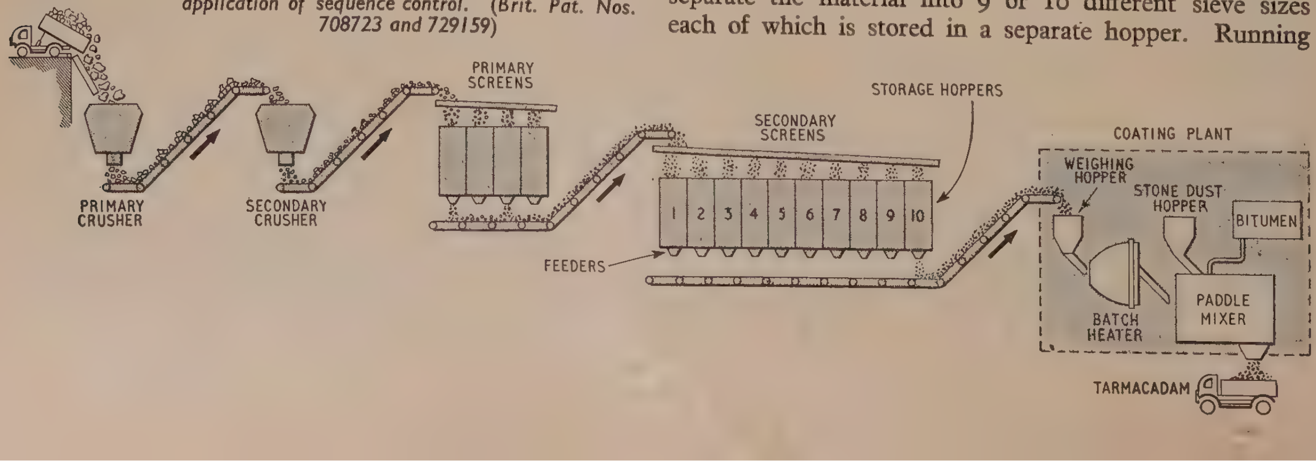
Applications of Sequence Control

A fundamental process in the steel industry is the production of pig iron. This is done in a blast furnace which is charged with iron ore, limestone and coke by a skip hoist. To obtain most satisfactory operation of the furnace, it must be possible to programme the number of skip loads of each required, and the order and position in which they are required to be discharged into the furnace. By the use of sequence control, automatic charging of the furnace in accordance with a preselected programme is provided.

Another application where sequence control has been widely applied is the modern plant for the production of road tarmacadam. Before giving examples of some sequence control systems used on a recent installation, a brief description of the process will be found useful. A simplified layout of the plant is shown in Fig. 3.

Quarried stone or blast furnace slag is fed by conveyor to primary and secondary crushers, the output of which is passed over vibrating screens. These ultimately separate the material into 9 or 10 different sieve sizes each of which is stored in a separate hopper. Running

Fig. 3.—Tarmacadam production plant is a good application of sequence control. (Brit. Pat. Nos. 708723 and 729159)



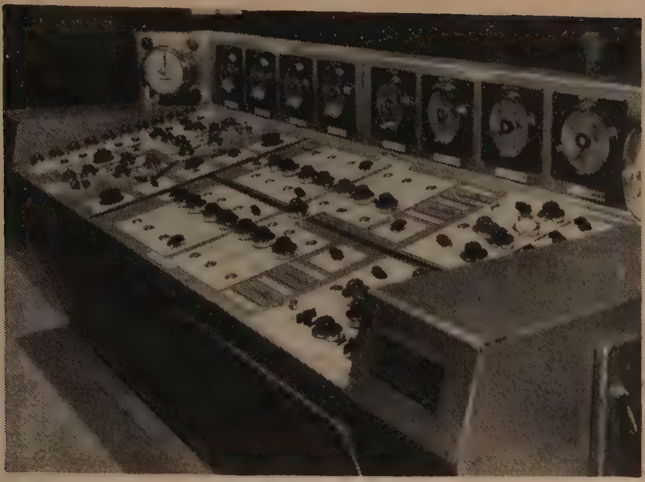


Fig. 4.—Main control desk for modern tarmacadam plant. (By courtesy of Stothert & Pitt, Ltd.)

under the outlets of these hoppers, and up to the plant where the stone is coated with bitumen, is a system of conveyors.

To fulfil a wide range of specifications which may be required, the control has to be arranged so that a total fixed batch weight of stone can be made up of preset proportions of any number of different stone sizes. The stone is fed from each hopper on to the conveyor by paddle feeders. When the graded batch of stone reaches the coating plant, it passes into a hopper from which it is discharged into a revolving batch heater.

Here the stone is heated for a preset time adequate to completely dry it. It is then discharged into a paddle mixer where a preset quantity of the chosen grade of bitumen is automatically added together with a measured quantity of stone dust if required. A metered quantity of fluxing oil can also be added automatically if required, its function being to control the setting rate of the product. When the batch has been mixed for the preset time, it is discharged either direct to road transport or into the appropriate storage hopper.

In the crushing and screening sections of the plant, sequence interlocking is employed as previously described so that the crushers, screens and associated conveyors are started in the correct order, i.e. the reverse order to the flow of material. This also provides the correct stopping sequence as illustrated in Fig. 2.

Sequence defeat switches are provided which cut out the sequence interlocking and allow each drive to be started and run out of sequence. This is found useful for testing and maintenance purposes.

Batch Selection

For operation of the grading control, it is essential that the quantity of stone fed from a particular hopper can be measured with fair accuracy. This has been achieved by driving a rotary cam type limit switch from each paddle feeder. These switches are arranged to operate their contacts after the feeder paddle has rotated through a certain angle. The aperture of the delivery chute is adjusted for each hopper so that this corresponds to a 2½ per cent delivery by weight in each case. The impulses obtained from these limit switches, one of which is fitted to the feeder drive on each hopper, are fed back to the grading control.

The composition of a batch in percentages by weight can be preset by setting switches which are provided for each material size. When a 100 per cent batch is correctly set up, it can be drawn from the storage hoppers in the correct proportions and delivered in an even flow to a conveyor which carries it to the coating plant.

It then passes through the coating plant automatically to emerge as the finished product. The control system is arranged so that the whole sequence from the delivery of the stone from the hoppers is automatic after initiation by a single pushbutton.

A photograph of the control desk for a tarmacadam plant is shown in Fig. 4.

In the grading section of the control, considerable use has been made of Post Office uniselector switches and relays. A photograph of a Post Office uniselector switch is shown in Fig. 5.

The stepping switches used are a standard type having 25 outlets per bank to each of which connection is made in turn by double-ended wipers. Up to eight separate banks can be fitted, giving a total of 200 outlets per unit.

The switch can be notched rapidly from one position to the next by energising and then de-energising its coil. It can also be " homed " at a high speed to any required contact position by supplying the coil through interruptor contacts fitted on the switch and connected in series with the coil. The position to which the switch " homes " is determined by the manner in which the contacts on the relevant bank are connected.

It has been found that many complicated control sequences which would require a considerable amount of control gear if conventional relay techniques were used can be carried out with relative simplicity and considerable saving of space by the use of stepping switches in conjunction with standard Post Office relays.

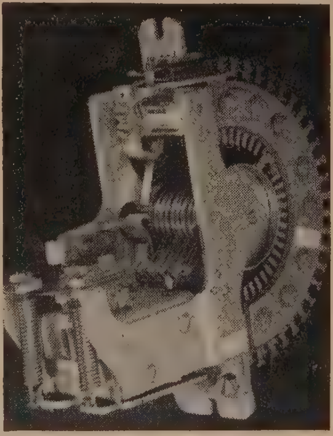


Fig. 5.—Five-bank Post Office uniselector switch

Another advantage of a system using stepping switches is that when the supply is reinstated after a power failure, the process can be continued from the point where it was interrupted. This is sometimes an important feature where the cost of having to scrap a partly processed product may be considerable. To achieve this by the use of latched relays often involves considerable complication.

Hopper Selection

On the grading control mentioned above, delivery of stone from the storage hoppers to the conveyor has to start with a size of stone selected in the specification and located in the hopper most remote from the coating plant. When the preselected quantity of stone has been supplied from this hopper, control has to be transferred to the adjacent hopper and a similar operation carried out. The pre-set quantity of material is supplied from each hopper, progressing in turn to the hopper nearest to the coating plant. In such a way, an even flow of material of the various stone sizes can be obtained on the conveyor belt without overlapping of the feed from consecutive hoppers and consequent spillage of material.

In addition, time is saved and output increased if the control can be arranged to start immediate feeder operation at the hopper containing one of the stone sizes required in the specification and most remotely situated from the coating plant. This can be illustrated by the case where there are 10 storage hoppers, No. 1 being farthest away from and No. 10 nearest to the coating plant. It is always necessary to provide a time delay between delivery from consecutive hoppers to allow the material discharged on to the conveyor from one hopper to clear the outlet of the adjacent hopper before delivery commences from it.

As an example, let us consider a specification calling for 100 per cent of the stone size stored in hopper 10 and assume that the conveyor speed and hopper outlet spacing are such that material on the conveyor takes 2 seconds to pass from one hopper chute to the next. It can be seen that, if the control started operation at No. 1 hopper and was then notched from hopper to hopper with the 2 seconds delay between each until the selected hopper was reached, a total delay of 18 seconds would occur between pressing the pushbutton to initiate operation and the commencement of stone delivery. Therefore a system which immediately homes to the first selected hopper would save 18 seconds each cycle.

Use of Uniselector Switches

It has been found possible to meet both of the control requirements described above by using a small number of uniselector switches each fitted with a number of contact banks. A multi-position selector switch is fitted on the grading control cubicle for each size of stone, each position moved through from the zero position representing an addition of 5 per cent to the amount to be delivered. In addition a second switch is provided for each stone size which allows an extra 2½ per cent to be added.

In the example given above, the selector switches for hoppers 1 to 9 inclusive are set at zero, in which position contacts on the switches are connected to a homing bank on each uniselector used in the hopper selection system. As soon as the uniselector is notched to its first position by operation of the start pushbutton, it " homes " immediately to its tenth contact where the " homing " circuit is interrupted since the 5 per cent selector switch for this hopper is away from its zero position and its relevant contacts are broken. On the tenth contact a circuit exists to pick up a pilot relay which, in turn, energises a contactor to start the paddle feeder motor on hopper 10 and the flow of material begins.

A normal specification would contain a number of stone sizes so that the feeders of several hoppers would operate in sequence. After the selected quantity of stone has been supplied from the first selected hopper and the necessary time delay has elapsed, an impulse is given to the hopper selection uniselector which notches on to its next contact. If stone is also required from the corresponding hopper, the relevant feeder motor runs until the correct quantity has been supplied. Otherwise the control notches on to the next hopper without energising the associated feeder. In this manner the uniselector notches from contact to contact until the preset quantity of stone has been supplied from each hopper.

The counting of the preselected quantity of stone from each hopper is also achieved by using uniselector switches. The control system allows each feeder motor to run until the correct number of impulses, each of which represents a 2½ per cent delivery, has been received by the counting uniselector switches. If a setting switch is at its zero position, the counting uniselectors are arranged to " home " immediately to their zero positions without energising the corresponding feeder.

Coating Plant

The coating section of a tarmacadam plant employs sequence control of the more conventional type using normal relay circuit techniques. The sequence is controlled by the operation of limit switches and timing devices. A considerable proportion of sequence control systems are dependent on devices of this type, which has resulted in the development of a wide range of such devices to suit the multiplicity of applications.

Back-up Protection

There are certain handling processes where maloperation of a part of the system could cause such damage and delay that it is considered worth while to include a checking system in the control to ensure that if the relevant part of the equipment has not functioned correctly, the plant is stopped before damage can occur.

An example of this, on a recent handling problem, was the use of a single conveyor which discharged on to a thrustor-operator changeover chute. Depending on the position of the chute, material can be diverted to either of two processing plants.

To obtain maximum output from the plant, it is necessary to have two batches of material on the conveyor at the same time, the composition of the two batches being different and one batch being routed to either processing plant. The control system is arranged to ensure there is sufficient gap available between the tail of one batch and the head of the following batch to allow the changeover chute time to operate should the route selection make this necessary.

If the chute failed to operate when required or stopped before it had taken up position correctly, a serious spillage of material would occur unless the conveyor could be stopped in time. Protection was provided against this by fitting two limit switches to be operated by the chute.

Electronics

An increasingly important role in sequence control systems is being played by electronics. By the use of punched card systems or magnetic tape, it is possible to store information regarding the operations to be carried out and the sequence in which they are to be performed. These can then be scanned electronically and the information translated into the required plant operation.

Such systems are now used on various forms of machine tools such as jig-boring and milling machines. They have also been applied to handling devices which are required to perform complicated sequences of operation automatically.

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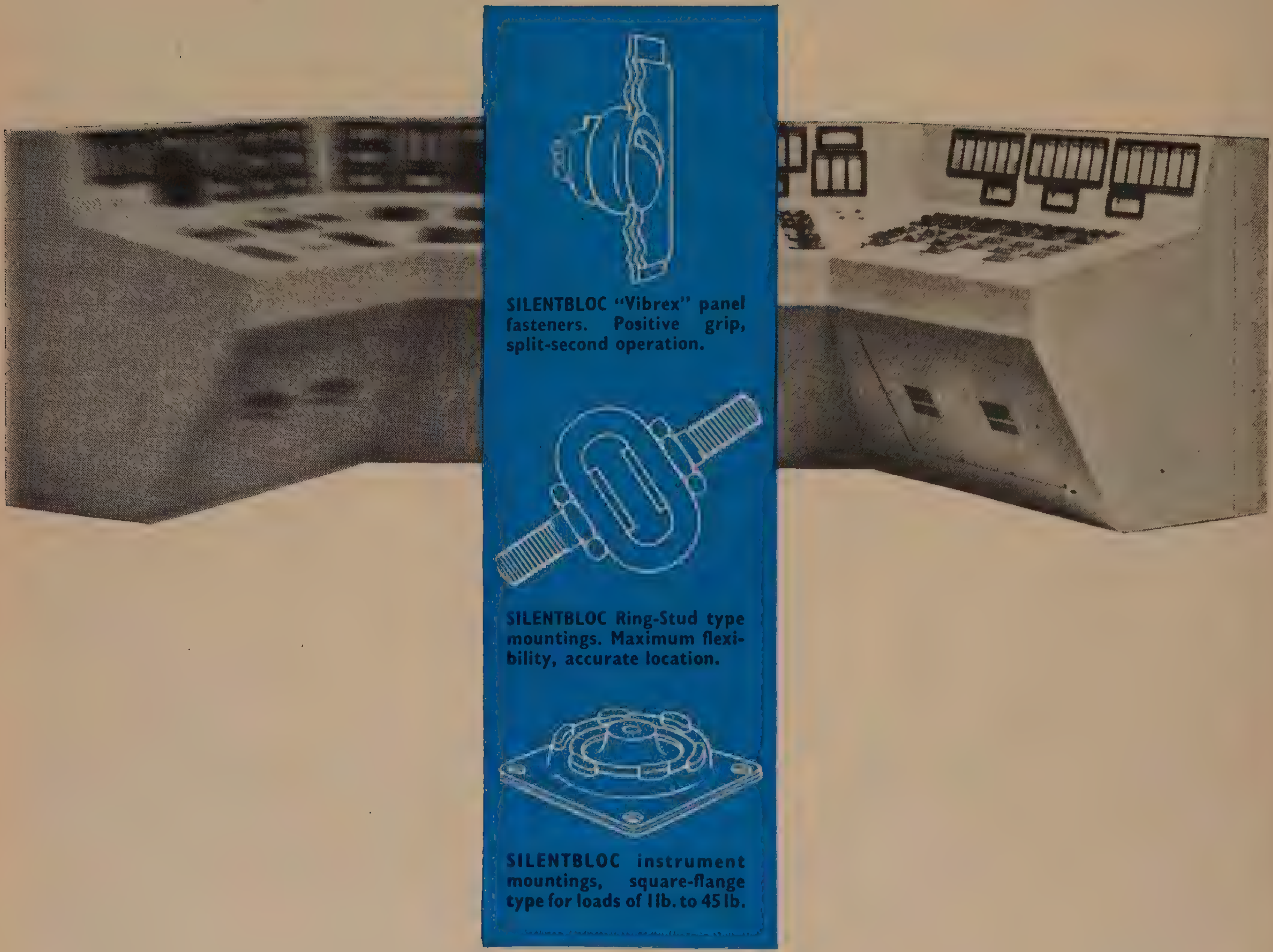
SILENTBLOC

instrument mountings



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SILENTBLOC instrument mountings, square-flange type for loads of 1 lb. to 45 lb.

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Vibration is the enemy of accuracy and serviceability. Silentbloc anti-vibration devices are the products of unrivalled experience and "know-how" in this field, and the extensive range available from stock is augmented by facilities for special design and production to meet exceptional needs. The illustrations show three of the many Silentbloc instrument mountings. We should be glad to consider your problems and to offer our advice without obligation.

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National Transport in 1959

Progress of Modernisation Plan

ALTHOUGH in 1959 the British Transport Commission again incurred a working deficit of £12·6 million, this was £15·5 million less than in the preceding year. The report and accounts published last week* show that the loss was entirely due to the railways which were £42 million (against £48·1 million) down on the year; there was a working surplus of £29·4 million (against £20 million) on the Commission's other undertakings. After debiting interest and other central charges, a loss of £84 million on British Railways was transferred to special account under the provision for deficit financing during the first phase of modernisation which Parliament has approved, and a net surplus of £10 million in respect of the other activities was transferred to net revenue account, against only £1 million in 1958.

The improvement shown by British Railways would have been greater had not the revival of the heavy industries lagged behind the boom in the rest of industry and if the tonnage of coal carried had not been further reduced.

Schemes Accelerated

Up to the end of 1959 the quickened pace of modernisation and rationalisation of the railways was fully maintained. Investment expenditure amounted to £168 million, as compared with £141 million in 1958. The suburban electrification schemes were being pressed ahead as rapidly as possible and steps were taken to advance the completion of main-line electrification between Euston, Birmingham, Crewe, Manchester and Liverpool by one or two years to 1964.

The first phase of the Kent Coast electrification was opened on 15th June, 1959; this involved the conversion of 78 route miles between Gillingham and Ramsgate, Faversham Junction and Dover Marine, and the Sheerness branch. In the second and final phase, embracing the lines from Maidstone East and Sevenoaks to Folkestone, Dover and Ramsgate (via Ashford), a total of 132 route miles is being converted. The scheduled completion date is June, 1962, but it is hoped to introduce some electric running in the second half of 1961. The extension of electrification in the Central and Western Sections of the Southern Region was still in the planning stage.

With regard to the first stage of the London Midland electrification between Euston, Liverpool and Manchester, the overhead equipment between Wilmslow and Sandbach was made " live " in the late summer of last year for trial running and training. Wiring in the Crewe station area was completed—over 80 single-track miles of equipment in one of the most complicated areas on the railways. Electrification of the Crewe-Manchester section is due for completion by the autumn of this year. Elsewhere good progress was made.

A great deal of work has been done in reconstructing bridges to give increased clearance for the catenary; the new electric depot at Longsight was completed and the first a.c. locomotive was received from the makers for trial running.

The electrification of the Colchester-Clacton-Walton line was completed last year, the d.c.-a.c. conversion of the already electrified lines from London to Chelmsford and Southend should be finished this year and a start has been made on closing the Colchester-Chelmsford gap. The Liverpool Street-Enfield, Chingford-Hertford East-Bishop's Stortford scheme should be ready to open this year and the work on the London, Tilbury and Southend line is making good progress.

The Commission and the Regions concerned are studying the eventual electrification of the East Coast main line and the continuation of the West Coast main-line electrification through to Glasgow. Work on the first stage of the Glasgow suburban electrification project progressed at an increasing tempo. In the Scottish Region experiments with the twin-unit battery railcar continued.

Particulars are given of the diesel services; by the end of 1959 some 420 main-line locomotives had been delivered; there were only 100 a year earlier. The Commission has so far approved the construction of a further 1,128 of these locomotives in the 1960-62 programmes. At the end of the year about 3,000 diesel multi-unit trains were in operation out of a total of 4,000 then authorised.

Reference is also made to the progress in the provision of colour light signalling, centralised traffic control, the automatic warning system of train control and improved communications.

One section of the report deals with the activities of the London Transport Executive in the replacement of out-of-date stock, the extension of its electrification from Rickmansworth to Amersham and Chesham and other improvements. Mention is made of the programme for the replacement of trolley-buses by oil-engined buses.

Increased Electricity Consumption

Electricity consumption during the year rose by 3·3 per cent to 1,055 million kWh of which the Southern Region was responsible for 739 million (3·4 per cent more). The greatest proportional increase (9 per cent) was naturally in the Eastern Region with its new extensions; its consumption was 148 million kWh. Three other regions actually used less electricity in 1959.

An analysis of rolling stock shows that at the close of the year there were 14,457 steam locomotives of all kinds (against 16,108 at the end of 1958); 357 diesel-mechanical and hydraulic locomotives (against 242); 1,442 diesel-electric locomotives (958); and 85 electric locomotives (72). The numbers of multiple units were as follows:—Diesel (all types): Power cars 1,933 (1,416); trailer cars

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* Vol. I (Report), H.C.216, price 6s; Vol. II (Accounts), H.C.216-1, price 15s.

1,319 (1,006). Electric: Power cars 2,601 (2,405); trailer cars 3,253 (2,865).

In the matter of research, reference is made to the study of the use of power-controlled rectifiers as the basis for a new control to supersede the present electro-mechanical gear, with the ultimate object of replacing the existing d.c. traction motors by a.c. machines in the locomotives working on the new 25 kV a.c. electrifications. If it is successful this will remove the difficulties associated with commutators and, it is hoped, lead to an appreciable saving in the cost and possibly weight of electric locomotives. Progress was made with the automatic wagon-recording project referred to in the last report and a development contract was placed with industry to design an electronic signal interlocking system. A number of driverless electronically-controlled trucks (" Robotugs ") were ordered for the projected freight terminal at Wolverhampton.

Among other matters referred to in the report is the Readership in Electric Traction established at the Imperial College, London, with the agreement of the College and the British Electrical and Allied Manufacturers' Association.

A profusely-illustrated and concise " popular " version of the report—" British Transport in 1959 "—has been produced by the Commission; it costs 2s.

"Son et Lumière" on H.M.S. "Victory"

ONE of the most unusual *Son et Lumière* spectacles yet produced in this country was switched on last week at Portsmouth, on Nelson's flagship, H.M.S. *Victory*. The cast, whose voices were recorded for the display, includes Sir Laurence Olivier, who plays the part of Nelson. The lighting was planned and provided by Atlas Lighting, Ltd., and a number of technical problems had to be overcome. The *Victory*, being constructed almost entirely of timber and tarred hemp, is a most difficult fire risk and, for this reason, the amount of lighting equipment installed inboard has been kept to the minimum. Only low voltage lamps of small wattage are used. Most of the main floodlighting is installed in the dock and on the dockside, and in order not to interfere with the normal working of the dockyard, the fittings had to be placed more closely to the vessel than would normally be the case.

The difficulty was overcome by using banks of weatherproof fluorescent fittings with various coloured tubes mounted only a few feet from the hull of the ship. Fluorescent equipment is also used to provide silhouette lighting, but this is supplemented by a number of 2 kW floodlights to give solidity to the masts and rigging.

A secondary bank of lights, mounted on the roof of an adjacent building, consists of a battery of narrow-angle 2 kW floodlights reinforced by four 3 kW " Infranor " projectors, and a group of 150 W low-voltage spotlights. All the lighting is remotely controlled by electronic dimmers. Two master control panels are used with a total capacity of 102 dimmer ways manually operated on cues provided by monitor speakers linked to the recording tape. The total load is approximately 65 kW, nearly 300 lamps and tubes are used and the total length of cabling is over 5,000 yd.

The installation was designed by Atlas engineers in co-operation with the Dockyard Electrical Department and the equipment was installed by Messrs. Reynolds, of Southsea. The sound equipment was supplied by Standard Telephones & Cables, Ltd., and consists of a triple amplifier and loudspeaker system which receives its sound input from a three-track stereophonic tape. Each of the three amplifiers is capable of delivering 150 W into the loudspeakers which are carefully designed to harmonise with the ship.

South African News

THE deputy chairman of the South African Atomic Energy Board, Dr. T. E. W. Schumann, said in Pretoria last week that the Board would spend about £4 million during the next five years on the construction of the Union's first nuclear reactor, which is being obtained from the United States. It is to be erected at Pelindaba, about 17 miles from Pretoria.

A factory which will eventually make the Union independent of outside manufacture of telecommunication equipment was opened at Boksburg last week by the Minister of the Interior, Mr. J. F. Naude. The Minister said this self-sufficiency could be vital to South Africa in an emergency. The factory has been built during the past 18 months by Standard Telephones & Cables at a cost of £500,000. At present it is capable of producing only a small proportion of the country's telecommunication instrument needs, but it is planned that during the next five years the plant will spread over its 71-acre site until it produces 75 per cent of the Union's requirements.

Electrical equipment for the 449 suburban railway coaches ordered by the South African Railways at a cost of nearly £10 million from the Union Carriage & Wagon Company (S.A.), Ltd., will be provided by Associated Electrical Industries (S.A.), Ltd. The cost of the electrical equipment will exceed £2·75 million. This is the first traction contract in which a substantial proportion of the electrical equipment will be manufactured in South Africa. Designs and supervision will be provided by Associated Electrical Industries and manufacture of the equipment will be carried out at Knights (Witwatersrand) by the First Electric Corporation of South Africa.

NEW ELECTRICAL EQUIPMENT

Cable Bands

Plastic cable bands for bunching ables and flexibles announced by Metway Electrical Industries, Ltd., Metway Works, Canning Street, Brighton, 7, are at present made in four izes—70, 140, 170 and 200 mm, with st prices of 14s 4d, 14s 8d, 15s 9d nd 19s 5d per 100 respectively. The 40 mm size can be obtained in orange, rey and black to order, as well as atural colour, and in coloured form ne price is 16s 2d per 100.

Re-designed "Creda" Cooker

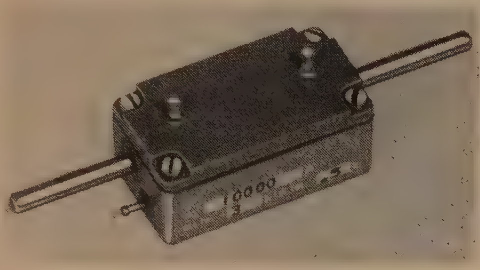
Two new accessories, a rotary spit nd a griddle, have been incorporated n the latest "Creda Mercury Super Four" electric cooker manufactured y the Simplex Electric Co., Ltd., Creda Works, Blythe Bridge, Stoke-n-Trent. The "Rosta-Spit" is a omplete and separate unit in itself. t is designed to clip on to a meat pan nd, when placed in the oven, automatically connects with a driving motor concealed at the back of the ooker. The motor is linked with the ven auto-timer control so that oven eat and the spit both start operating ogether at any pre-selected time.

The griddle consists of a large plate f machine-polished cast aluminium nd is designed to fit over the front wo "Quick-disc" hotplates on the ob. So that the food remains dry nd is not frying, the griddle is urrounded by a channel which llows fat to run into a basting well t the front. A collapsible handle is rovided to enable the griddle to be lifted from the cooker without the use of an oven cloth. The price of the cooker, complete with the new accessories, is 55 gns.

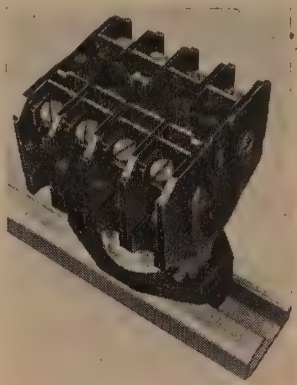
"Creda Mercury Super Four" cooker with the new rotary grill

Rectilinear Potentiometer

A rectilinear potentiometer with balanced suspension wipers to overcome the problem of wiper separation from the resistance element under extreme environmental conditions of shock and vibration is now being produced by General Controls, Ltd., 13-15, Bowlers Croft, Honywood Road, Basildon, Essex. The unit has a "U" shaped wiper member which is held in a pressure equilibrium between the commutator rod and resistive element. Any external forces which tend to alter the wiper contact pressures against the resistive element cause an equal and opposite reaction at the commutator side of the wiper, thereby ensuring that constant wiper arm pressure is maintained. Such a system holds contact noise and pickoff signal discontinuity to a minimum and prevents damaging wiper pressure against the resistive element. The potentiometer has dimensions of $1\frac{11}{32}$in by $\frac{5}{8}$in by $\frac{3}{4}$in and a stroke of 0·825in, and the maximum number of taps is five including end connections. The resistance range is from 100 to 10,000 Ω, the resistance tolerance being ±3 per cent, and the power rating of 1·5 W is derated to 0 W at 100°C. Breakdown voltage is 1,000 V r.m.s.



General Controls rectilinear potentiometer



Londex miniature contactor

Miniature Contactors

A range of miniature contactors with double break contact action has been announced by Londex, Ltd., Anerley Works, 207, Anerley Road, London, S.E.20. The contact formations available include 4 make; 4 make 2 break; 4 make 4 break; 6 make; and 6 make 2 break. The contacts have ratings from 7 A at 400 V or 3 A at 550 V with a life of 500,000 operations at a maximum switching rate of 40 per hr, to 1 A at 400 or 0·4 A at 550 V when operated at a maximum switching rate of 3,000 per hr for a life of 10 million operations. Coils for 50 c/s operation can be supplied from stock wound for 110, 125, 190 and 220 V while coils for 380 and 500 V inputs can be supplied. The prices of the units range from 32s 6d to 47s 6d each.

The contactors are mounted without fixing screws, in a special channel section. Adjustable thermal overload units can be supplied which fit to the contactors without additional wiring. These are available with two ratings, from 0·15 to 4·5 A and from 0·25 to 7 A.

Rocker Contact Switches

A range of moulded rubber pole rocker contact switches including models having a central "off" position is now being manufactured by A. F. Bulgin & Co., Ltd., Bye Pass Road, Barking, Essex. There are 8 models in the range offering a variety of contact arrangements. The maximum current rating for all types varies from 6 to 10 A at 200 V a.c. depending on the circuit conditions, 10 A at up to 125 V a.c. or 10 A at up to 28 V d.c. for non-reactive circuits. The maximum working voltage is 250 V to earth and between poles and the maximum test voltage is 2 kV. All models are suitable for panels up to $\frac{13}{64}$in thick and require a hole to suit a $\frac{15}{32}$in bush. Connection-head terminal screws of 4 BA size are fitted. The switch body is moulded in polished thermo-setting bakelite material.

Capacitance Relay

A transistorised capacitance relay has recently been added to the range of electronic instruments made by Bailey Meters & Controls, Ltd.,

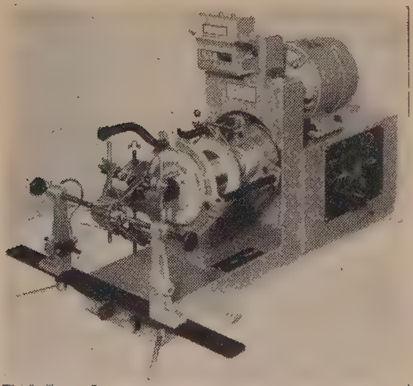
Bailey Meters & Controls capacitance relay

Purley Way, Croydon, Surrey. The instrument operates on the capacity method and is available for direct mounting, with the probe integral with the relay, and as a wall mounting type with the probe connected by a coaxial cable. The instrument housing of both types is weather-proofed and of aluminium alloy construction, giving adequate protection to the transistors and printed circuit.

An electricity supply at 110-120 V or 200-240 V single-phase 50 c/s is required. The power consumption, excluding external alarm devices, is approximately 3 W. The sensitivity is better than 0·1 pF under all conditions, and it is stable to within 0·15 pF of the mean value over six months, with the same supply voltage and temperature. Provision is incorporated for increasing the relay differential from the minimum value of 0·05 pF to any required value between 1 pF and 25 pF. The relay has sealed triple-pole change-over contacts capable of switching 5 A at 250 V a.c.

Armature Winding Machine

A new and improved design of their "Quickway" armature winding machine is being marketed by the MIDLAND DYNAMO CO., LTD., Belgrave Gate, Leicester. This machine now incorporates an infinitely variable speed d.c. drive providing a smooth, stepless variation throughout the winding speed range of up to 1,000 turns per minute — according to individual requirements and application. Designed for bench mounting, the equipment is for use on a standard, single-phase supply, the d.c. voltage being obtained from metal rectifiers built into the base of the machine. In this equipment the established principle of winding with the armature stationary has been retained.



Midland Dynamo armature winding machine

Paper Tubular Condensers

A new range of insulated condensers complying with the requirements of Inter-Services Specification R.C.S.131, 40/100 H.1, and conforming to sizes in R.C.L.131 (CP.31 style), all suitable for working at −40° to +100°C, has been introduced by the TELEGRAPH CONDENSER CO., LTD. (Radio Division), North Acton, London, W.3. These condensers are of foil and paper dielectric non-inductively wound and impregnated with "Visconol-X" compound which improves the performance of paper insulation by inhibiting ionisation and checking the fall in insulation resistance following temperature rises. The elements are housed in epoxy-phenolic resin-bonded glass fibre with end seals of a resin affording a complete protection against the ingress of moisture in service. The range covers from 0·001 to 1·0 μF at d.c. working voltages of 100, 175, 350, 500 and 650 V at 100°C and 200, 350, 500, 750 and 1,000 V at 70°C.

Clip-on Voltammeter

The small portable clip-on voltammeter, the "Miniclip," introduced by FERRANTI, LTD., Hollinwood, Lancs., provides three voltage ranges, 0-150-300-750 V, and five current ranges, 0-4-12-40-120-400 A. It comprises a current transformer and a rectifier instrument housed in a black bakelite case designed to fit the hand. The thumb-operated selector switch, a knurled ring set into the body, also selects the appropriate scale so that the use of multiplication factors is avoided. Accuracy is within ±3 per cent of full scale on all ranges.

Ferranti clip-on voltammeter

It can be used with complete safety on bare conductors up to 600 V a.c., as all metal parts except magnetic contact surfaces are fully insulated, and it will clip round conductors up to 1in diameter. A special plug with two leads and clips, fitting into the base of the instrument, provides the connections for voltage measurement. The "Miniclip" is provided with a cloth reinforced plastic carrying case holding both the meter and the leads. Overall dimensions of the instrument are 8in by 1$\frac{9}{16}$in by 2$\frac{3}{4}$in, and the weight with voltage leads is less than 21 oz.

Coffee Percolator

A new fully automatic electric coffee percolator, the "Sona," is now being manufactured by N. C. JOSEPH, LTD., Aluminium Works, Stratford-on-Avon. It has a capacity of 2$\frac{3}{4}$ pt (10 cups) and with it coffee can be made ready to serve within 12-14 minutes. It is fitted with a 600 W tubular heating element which is embedded into an aluminium pressure die-casting. This ensures fast and even heat distribution —percolation commences within 45 seconds of switching on. When the coffee is ready to serve, a snap-action type thermostat switches off the heating element and lights an indicator. To keep the coffee at serving temperature until the percolator is disconnected, the heating element is automatically switched on again every 20-25 minutes.

"Sona" automatic electric coffee percolator (N. C. Joseph, Ltd.)

The percolator is constructed of aluminium and the exterior is chromium plated. The handle, base and the lid knob are of a heat resisting moulded material and all interior parts (percolator basket, spreader, pump washer, etc.) are of aluminium. All internal wiring connections are doubly insulated and a detachable connector and 4ft of 3-core flexible are supplied. The overall height is approximately 12in and the price is £5 12s 6d, including 17s 4$\frac{1}{2}$d purchase tax.

These 3 outstanding uniselectors

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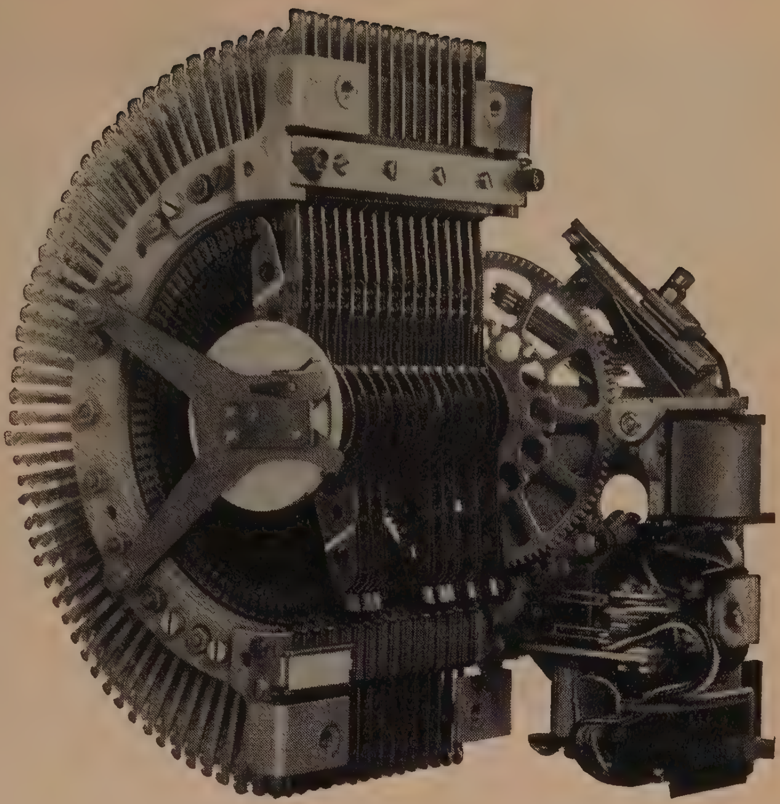
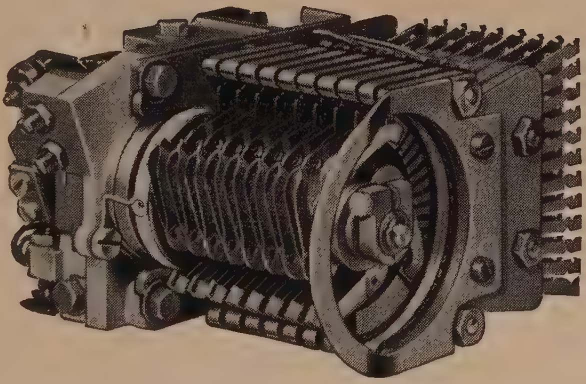


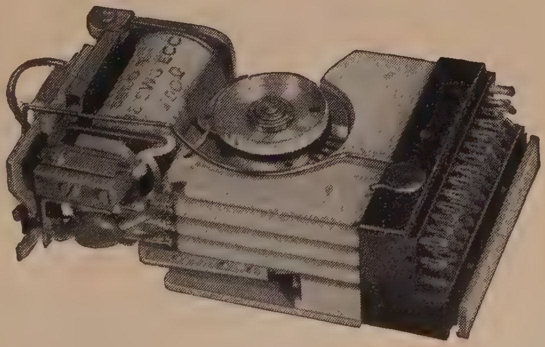
he high speed motor uniselector

as an availability of 52 outlets in a half volution with up to 16 parallel channels, nd is capable of high speed search if quired. It is also suitable for scanning nd other collection functions, or for the outing of information to a multitude of oints. It can be brought to rest at any esired outlet by means of simple circuitry, nd a homing drive is provided so that it an be readily restored to the normal osition. Arrangements can also be made r step-by-step working.



he digit switch

s specifically designed for step-by-step peration in response to impulses, and has n availability of 12 outlets with 8 parallel hannels. It may be used to set up a marking condition for the control of the Motor Uniselector.



he miniature uniselector

s a compact switch of unique design which ccupies no more space than a standard 3000-type relay. It has an availability of 2 outlets with 3 parallel channels. A great advantage is that it incorporates a plug-in type of mounting so that the entire device can be removed and replaced without detaching any soldered connections.

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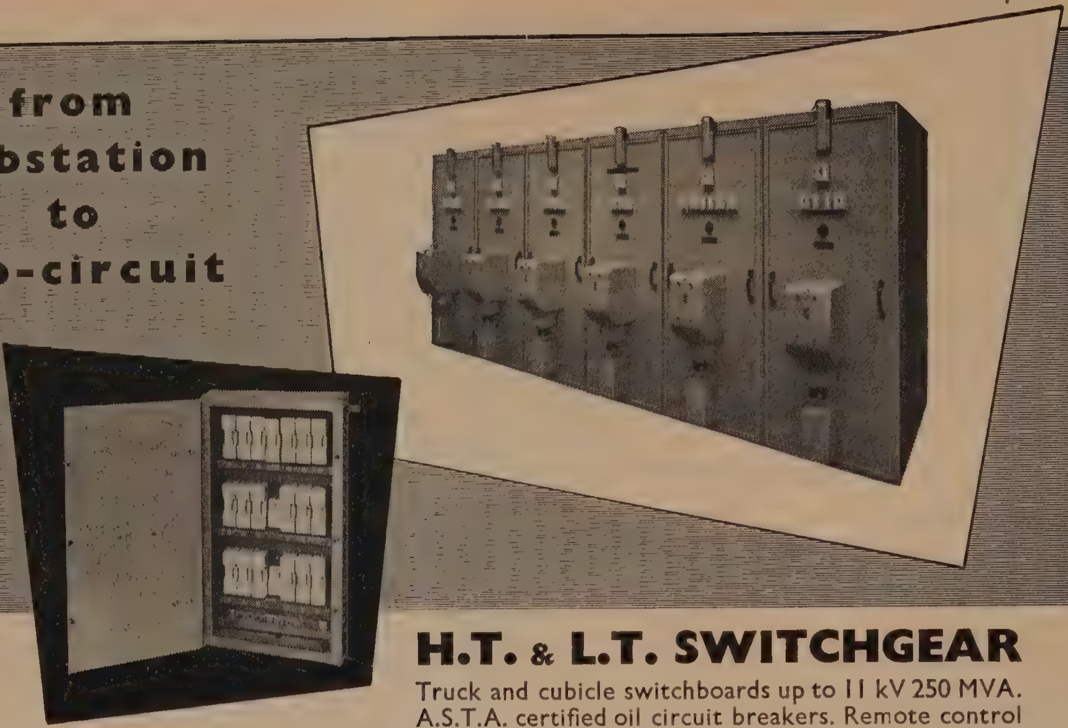

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Automatic-Blanket Production

New Crawley Factory Opened

IN the *Electrical Review* of 8th April (page 718) reference was made to an electrically heated automatic blanket which was shortly to be placed on the market in this country. It has now been disclosed that the manufacturers are the Monogram Electric, Ltd., a British affiliate of the International General Electric Co. of New York, Ltd. Recently we had the opportunity of visiting the company's new factory at Gatwick Road, Crawley, where production of the blanket has now started. At present the number of blankets being manufactured is not large but facilities are available for producing up to 4,000 blankets per week once full production has started.

The blanket material, a mixture of wool, rayon and cotton, is delivered to the factory in rolls, each of which contains 50 blanket lengths. The material is then cut off into lengths, pulled over a lighted table and inspected for faults and then laid out on to a shuttling table. Here the blanket wire is inserted into woven channels already in the material, by means of shuttles on which the lengths of blanket wire are wound. Single blankets have one wire length of 125ft and double blankets have two lengths, each of 88ft. The blanket is then passed to the sewing machine work station where terminal pins are crimped to the wire. The construction of the wire is such that it contains both a heating element wire and a signal wire insulated from each other by nylon. The two wires must remain insulated from one another at the point of termination—hence the terminal pins. The pins are then firmly located in a plastic moulding tool and passed to an injection moulding machine where a complete plug is formed around them. At this stage, continuity and high voltage insulation tests (2,000 V) are carried out. The blanket is then completed by final sewing and bound with nylon taffeta and is then again inspected over a lighted table and electrically tested.

The casing of the blanket control unit and all other plastic parts are produced in the factory on a 50-ton compression moulding machine. After passing through a number of stages, where such items as rectifiers, condensers, resistors, etc., are added, the complete control assembly is submitted to tests in a calibration room. The temperature in this room is maintained at 73°F and here the control knob is placed in position at the correct temperature setting. The cord set, or cable harness, is also added at this stage and the whole is then finally passed to the dispatch section.

A blanket undergoing water tests in the laboratory. The control unit can be clearly seen

In this view of the "Monogram" blanket factory the elements, wound on aluminium shuttles, are shown being inserted into the blanket

The special element wire and much of the control equipment used in the construction of the blanket is at present being imported from America, but these will eventually be produced in the factory. Because of the nature of its construction, the blanket material need not be flameproofed and it can be washed in the normal manner. Convincing proof of this was given in the company's laboratory where a blanket was seen working, though fully immersed in water. Another blanket was being submitted to tests in a standard domestic washing machine.

It is understood that distribution will start in the autumn through wholesalers and Electricity Boards in the London area and south-eastern counties of England and will gradually expand as production increases.

Three models are being manufactured—the G.A.11 single (size 85 × 60in); G.A.12 double (85 × 80in); and G.A.13 dual (85 × 80in). The respective prices, including purchase tax, are £11 11s; £13 13s; and £15 15s. The colours are rose pink, Capri blue and sea foam green and all are suitable for the 200/250 voltage range.

Servo-Mechanism Components

THE British Standard "Graphical Symbols for Components of Servo-Mechanisms, Part 1: Transductors and Magnetic Amplifiers" (B.S. 3238 : 1960, obtainable from the British Standards Institution, 2, Park Street, London, W.1, price 4s 6d) is the first part of a standard which will serve as a companion volume to B.S. 1523 : Section 5 : 1954. This 15-page publication tabulates graphical symbols for diagrams containing transductors and magnetic amplifiers and an appendix provides a series of useful notes on polarity marking. Part II will contain graphical symbols for other servo-mechanism components.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1955

11791. Simplex Electric Co., Ltd.—Electrically heated cooking appliances. 23rd April, 1956. (838774.)

12815. Siemens & General Electric Railway Signal Co., Ltd., and Candler, J. E.—A.c. electric relays of the induction type. 2nd May, 1956. (838491.)

14885. Bolser, M.—Electric space heating and electric heating elements. 23rd August, 1956. (Cognate application 30235, 22nd October, 1955.) (838052.)

17390. Electric & Musical Industries, Ltd.—Automatic control apparatus especially adapted for controlling automatic weighing machines. 18th June, 1956. (838621.)

18396. Parnall (Yate), Ltd.—Electric ovens. 7th August, 1956. (838778.)

18714. Thorn Electrical Industries, Ltd.—Trans-illuminated panels. 19th July, 1956. (838431.)

20364. Automatic Telephone & Electric Co., Ltd.—Cold cathode gas discharge tubes and circuit arrangements employing such tubes. 6th July, 1956. (838213.)

21172. Ritchie, J., and White-Parsons, G. D.—Electric conductors. 23rd July, 1956. (838494.)

22032. Henley's Telegraph Works Co., Ltd., W. T.—Metallised semiconducting carbon black paper. 26th July, 1956. (838053.)

22881. Electric & Musical Industries, Ltd.—Printed circuits. 19th July, 1956. (838495.)

22951. British Thomson-Houston Co., Ltd.—Electric rectifiers employing semiconductors. 20th July, 1956. (838432.)

23263. English Electric Co., Ltd.—Commutators for dynamo-electric machines. 10th August, 1956. (838496.)

23320. Grubb Parsons & Co., Ltd., Sir H.—Self-balancing electrical instruments. 2nd August, 1956. (838214.)

24102. Waller, C. A.—Electrically heated carpets or floor coverings. 22nd August, 1956. (838497.)

24363. British Insulated Callender's Cables, Ltd.—Electric cable installations. 14th September, 1956. (838498.)

25000. British Thomson-Houston Co., Ltd.—Seals for electric discharge lamps. 2nd August, 1956. (Addition to 793041.) (838779.)

27100. British Thomson-Houston Co., Ltd.—Electric motor control systems. 18th September, 1956. (838781.)

27279. Electric & Musical Industries, Ltd.—Electric filter circuits. 24th September, 1956. (838433.)

28148. Venner, Ltd., and Horgan, W. F.—Mechanical selector mechanism for time controlled apparatus. 27th September, 1956. (838218.)

28631. English Electric Co., Ltd.—Condensing steam turbines. 3rd October, 1956. (838092.)

29209. Sangamo Weston, Ltd.—Moving coil electrical instruments of the permanent magnet-core type. 12th October, 1956. (838056.)

29860. Whiffen, Ltd., R.—Electrical post insulators. 14th September, 1956. (838782.)

33395. English Electric Co., Ltd.—Transductors. 15th November, 1956. (838220.)

33583. Racal Engineering, Ltd.—Electrical modulation circuits. 23rd November, 1956. (838058.)

34119. English Electric Co., Ltd.—Fluid operated electric switches. 21st November, 1956. (838291.)

37004. English Electric Co., Ltd.—Charge chutes for atomic reactors. 13th December, 1956. (838292.)

1956

2090. Automatic Telephone & Electric Co., Ltd.—Monitoring arrangements. 20th December, 1956. (838783.)

2937 and 23313. Grubb Parsons & Co., Ltd., Sir H.—A.c. frequency changing apparatus. 18th January and 19th June, 1957. (838215/6.)

5629. International Computers & Tabulators, Ltd.—Electronic computing apparatus. 9th January, 1957. (838411.) 6818. Signal translating apparatus. 1st March, 1957. (838786.)

8781. Felden Engineering Co., Ltd.—Operating circuits for electric discharge lamps. 21st March, 1957. (838293.)

11198. Nielsen Co., Ltd., A. C. (Nielsen Co., A. C.).—Apparatus for indicating at a remote point the tuning condition of a plurality of wave signal receivers. 12th April, 1956. (838346.)

13018. Rheostatic Co., Ltd.—Temperature sensitive devices for use in conjunction with temperature control systems. 27th March, 1957. (838295.)

13036. Siemens & Halske A.G.—Voltage-dependent capacitors. 27th April, 1956. (838512.)

13389. Metropolitan-Vickers Electrical Co., Ltd.—Earth leakage protection systems for electrical circuits. 16th July, 1957. (838513.)

13737. Radio Corporation of America.—Electrical display device. 3rd May, 1956. (838624.)

13827. Standard Telephones & Cables, Ltd. (International Telephone & Telegraph Corporation).—Radio navigation beacon system. 4th May, 1956. (838788.)

14155. Radio Corporation of America.—Gas tight seals in electron discharge tubes. 7th May, 1956. (838011.)

17608. National Research Development Corporation.—Electron discharge apparatus. 7th June, 1956. (838626.)

18263. Albright & Wilson (Mfg.), Ltd.—Printed electric circuits and method of producing them. 13th June, 1956. (838096.)

19172. Thorn Electrical Industries, Ltd.—Electric discharge lamp circuits. 7th June, 1957. (838517.)

19252. Reyrolle & Co., Ltd., A.—Electric protective relay devices. 21st June, 1956. (838298.)

19322. Telefunken G.m.b.H.—Radio communicating systems. 21st June, 1956. (838013.)

19408. Reyrolle & Co., Ltd., A.—Electromagnetic relays. 22nd June, 1956. (838299.)

21145. Ericsson Telephones, Ltd.—Electrical switching devices. 24th June, 1957. (838348.)

22078. Stern, W. L.—Electromagnetic relays. 1st July, 1957. (838877.)

22513. National Research Development Corporation.—Cathode-ray tubes. 20th July, 1956. (838437.)

22718. Philips Electrical Industries, Ltd.—Devices for amplifying voltages. 23rd July, 1956. (838438.)

23285. Licentia Patent-Verwaltungs G.m.b.H.—Electric liquid jet current convertor. 27th July, 1956. (838531.)

24073. Standard Telephones & Cables, Ltd.—Electron discharge devices. 3rd August, 1956. (838016.)

24317. Chicago Telephone Supply Corporation.—Variable resistor. 8th August, 1956. (838439.)

24829. General Electric Co.—Current controlling devices. 14th August, 1956. (838076.)

25047. Telefunken G.m.b.H.—Push-pull transistor amplifiers. 16th August, 1956. (838077.)

25960. Standard Telephones & Cables, Ltd.—Thermometer type voltage indicator tube. 24th August, 1956. (838078.)

26453. Pertrix-Union G.m.b.H.—Electric dry cell. 29th August, 1956. (838079.)

26926. Plessey Co., Ltd.—Indirectly heated incandescent cathodes. 26th August, 1957. (838099.)

27177. Ridding, J. W. (General Electric Co.).—Combustion system, particularly suitable for gas turbine starters. 5th September, 1956. (838641.)

28425. Mond Nickel Co., Ltd.—Neutron-absorbing bodies for use in nuclear reactors. 30th August, 1957. (Cognate application 34585, 12th November, 1956.) (838442.)

28460. International Business Machines Corporation.—Electrical conductors and assembly thereof. 18th September, 1956. (838818.)

29135. Metropolitan-Vickers Electrical Co., Ltd.—Thermonuclear apparatus. 12th September, 1957. (838443.)

29624. Dunlop Rubber Co., Ltd.—Electric switching apparatus for controlling machines. 28th September, 1956. (Addition to 814606.) (838445.)

30239. Standard Telephones & Cables, Ltd.—Electron discharge devices. 4th October, 1956. (838017.)

30949. International Business Machines Corporation.—Electronic computer checking circuits. 11th October, 1956. (838301.)

31048-51. Pye, Ltd.—Electrostatic loudspeakers. 11th October, 1957. (838021-4.)

31471. Heraeus Quarzschmelze G.m.b.H.—Electric heating radiators. 16th October, 1956. (838101.)

32525. National Research Development Corporation.—Electrical relays. 25th October, 1957. (838823.)

33056. Bulpitt & Sons, Ltd.—Electrically heated water jugs and the like. 29th January, 1958. (838879.)

34168. Brown, Boveri & Cie. A.G.—Fluid-actuated transformer tap-changing switching device. 8th November, 1956. (838643.)

34525. Licentia Patent-Verwaltungs G.m.b.H.—Artificial a.c. networks. [illegible]th November, 1956. (838880.)

34532. A.B. Metal Products, Ltd.—Electrical switches. 31st October, 1957. (838644.)

35582. Plessey Co., Ltd.—Television scanning devices. 21st November, 1957. (837977.)

35682. Stauffer Chemical Co.—Method of and apparatus for heating materials by electric discharges. 22nd November, 1956. (838846.)

36525. Veltechna, Narodni Podnik, Holusa, J., Strejcek, V., Vanicek, H., and Zeman, J.—Alarm system for signalling faults or disturbances in electrical installations. 29th November, 1956. (838506.)

36673. Electrical Apparatus Co., Inc.—Quick-action electrical switches and actuating devices therefor. 30th November, 1956. (838391.)

36678. Standard Telephones & Cables, Ltd.—Radio beacon receiver. 30th November, 1956. (838847.)

37285. Plessey Co., Ltd.—Ferromagnetic yokes. 27th February, 1958. (837981.)

37697. Siemens-Schuckertwerke A.G.—Liquid-blast electric switches. 10th December, 1956. (838653.)

37794. General Mills, Inc.—Radar tester. 11th December, 1956. (838646.)

[Continued on page 85

Cut the 'down' time

The use of E.M.B. draw-out resistances ensures the speedy replacement of grid banks when necessary.

Simply remove the 2 set pins and slide out the grid bank without straining or lifting!

There's no need to have space back and front—if it's arranged to withdraw from the front, there's no room needed at the back and vice versa.

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We can give quick delivery!

TYPES

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SHOCKPROOF where resistances are subjected to heavy vibration—extra support for grid rods and heavier sides.

STEEL WORKS with bakelite secondary insulation of grid rods. This type can be supplied with the extra rod supports to resist excessive shock if necessary.

DRAW-OUT. Each bank of grids is carried on a slide so that it can be quickly replaced. This feature can be supplied to any of the above types.

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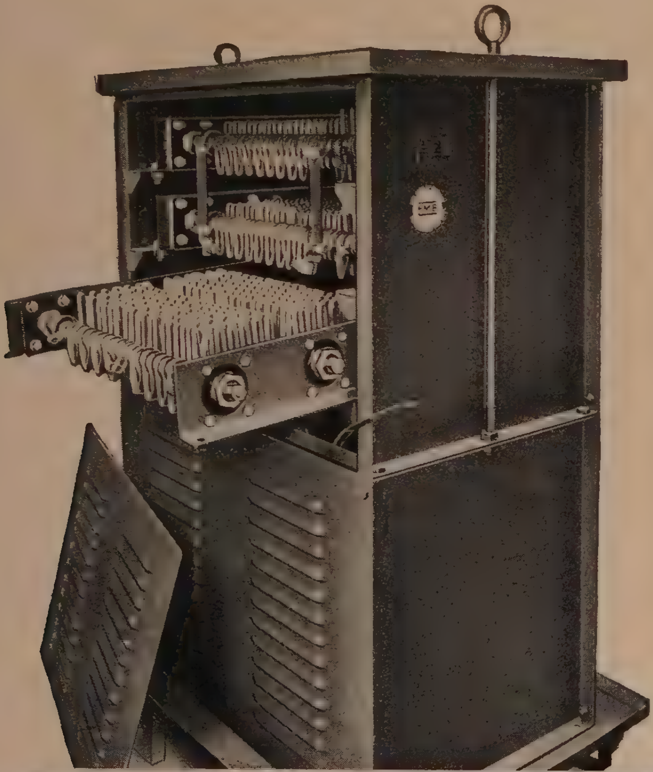
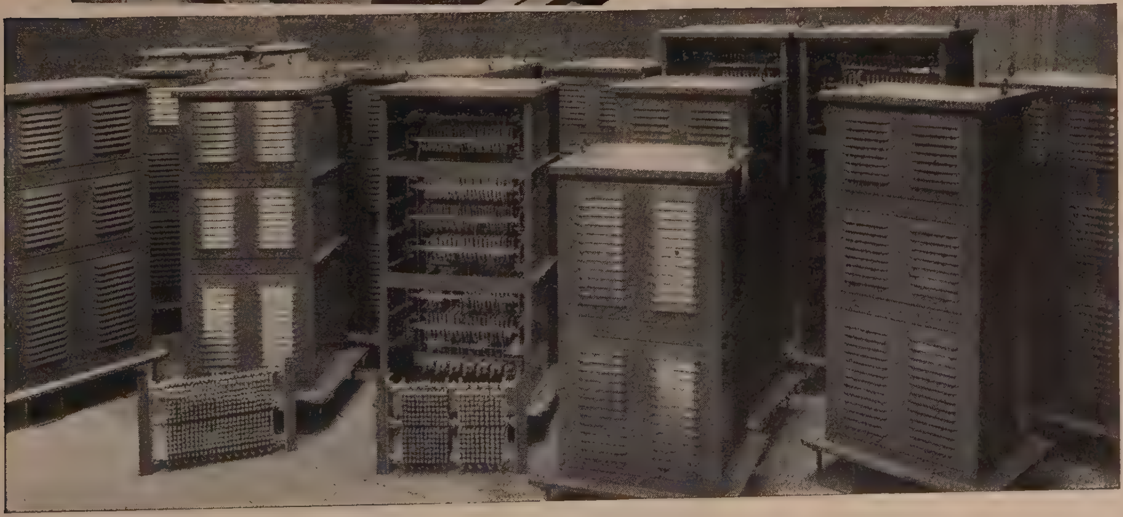


E.M.B. Co. Ltd.

West Bromwich —————— England



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ELLISON STARTERS give
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New Patents (*continued*)

38142. National Research Development Corporation.—Frequency modulated oscillator circuits. 13th December, 1956. (838229.)

38538. Foster Transformers, Ltd., and Jennings, R. E.—Variable voltage electric transformers. 12th December, 1957. (838103.)

38965. General Electric Co.—Magnetic deflection systems for cathode-rays and like tubes. 21st December, 1956. (838540.)

1957

1650. Compagnie Française Thomson-Houston.—Fluid cooling of high power electron-discharge tubes. 16th January, 1957. (838105.)

1714. General Electric Co., Ltd.—Inverse time/current electric circuit arrangements. 14th January, 1958. (838521.)

2012. Carr Fastener Co., Ltd.—Printed circuit edge connectors. 12th February, 1958. (838543.)

2990. A.E.I.-John Thompson Nuclear Energy Co., Ltd.—Nuclear reactors. 10th January, 1958. (838450.)

5989. Bernier, R.—Movable contacts for electromagnetic relays. 25th February, 1958. (838958.)

6743. Marconi's Wireless Telegraph Co., Ltd.—Binary counting devices. 26th September, 1957. (838303.)

7767. Licentia Patent-Verwaltungs-G.m.b.H.—Hydraulically actuated electric switching device. 8th March, 1957. (838971.)

10389. General Electric Co., Ltd.—Field excitation arrangements for d.c. motors. 31st March, 1958. (838104.)

11062. Carlsen, J.—Electric flat iron with a thermo-switch. 4th April, 1957. (838712.)

12800. Carr Fastener Co., Ltd.—Holders for thermionic valves, electrical plugs or other electrical devices having projecting terminal prongs. 10th April, 1958. (838423.)

13977. Automatic Telephone & Electric Co., Ltd.—Termination of fine wires. 11th April, 1958. (838112.)

14207. General Electric Co., Ltd.—Interbogie control arrangements for railway locomotives or other vehicles. 27th June, 1958. (838936.)

15134. British Thomson-Houston Co., Ltd.—Electric testing and measuring circuits. 1st May, 1958. (Addition to 836784.) (838306.)

17362. Lorenz A.G., C.—Radio direction finding system. 31st May, 1957. (838607.)

18467. Dorman & Smith, Ltd.—Electric circuit-breakers. 12th June, 1958. (838399.)

18817. British Oxygen Co., Ltd.—Electrical liquid-sensing device. 10th June, 1958. (838308.)

19156. Philco Corporation.—Electrolytic surface treatment. 18th June, 1957. (838400.)

20168. Crompton Parkinson, Ltd.—Armouring and separating sheets for secondary batteries. 25th June, 1958. (838310.)

21587. General Electric Co., Ltd.—Operating circuits for electric discharge lamps. 23rd July, 1958. (838456.)

22032. Collins Radio Co.—Positive-negative counting device. 11th July, 1957. (838314.)

22465. Monitor Patent Safety Devices, Ltd., and Stokoe, C. L.—Electric switches in connection with fluid-flow meters and the like. 7th July, 1958. (838121.)

22550. Mycalex & T.I.M., Ltd.—Electric circuit connecting devices. 15th July, 1958. (838315.)

22688. Thorn Electrical Industries, Ltd.—Lighting fittings. 14th July, 1958. (838122.)

22788. Philips Electrical Industries, Ltd.—Electrical connections. 18th July, 1957. (838123.)

24326. Brattel, A. T.—Electric grillers or like cooking appliances. 30th July, 1958. (838650.)

24746. Ledermann, H.—Electrode steam heaters. 6th August, 1957. (838459.)

26718. British Thomson-Houston Co., Ltd.—Control systems for a.c. commutator motors. 22nd August, 1958. (838906.)

28108. Ferguson Radio Corporation, Ltd.—Transistor circuits. 28th August, 1958. (838731.)

28956. General Electric Co., Ltd.—Transistors. 10th September, 1958. (Addition to 809071.) (838987.)

29084. Siemens & Halske A.G.—Polarised electromagnetic relays. 16th September, 1957. (838988.)

29321. British Insulated Callender's Cables, Ltd.—Clips for supporting electric cables and the like. 16th September, 1958. (838734.)

29707. Siemens & Halske A.G.—Voltage responsive relay circuit arrangements. 20th September, 1957. (838238.)

30360. Metropolitan-Vickers Electrical Co., Ltd.—High pressure testing apparatus. 9th July, 1958. (838139.)

31177. British Thomson-Houston Co., Ltd.—Dynamic braking of induction motors. 16th September, 1958. (838881.)

31760. United Kingdom Atomic Energy Authority.—Discharge devices for producing nuclear reactions by bombarding a target material with hydrogen ions. 6th October, 1958. (838461.)

32729. Compagnie Financiere Immobiliere et Mobiliere Cofimo.—Cable protecting devices for electrical apparatus. 21st October, 1957. (838241.)

34641. Elektrokemisk A.S.—Electric smelting furnaces provided with self-baking electrodes. 6th November, 1957. (838146.)

35135. General Electric Co., Ltd.—Electromagnetic waveguide devices. 11th November, 1958. (838149.)

35137. Douglas, J. C.—Electrically heated toilet seat. 6th November, 1958. (838243.)

35421. British Insulated Callender's Cables, Ltd.—Devices for protecting series capacitors. 13th November, 1958. (838150.)

36486. Philips Electrical Industries, Ltd.—Transistor circuit arrangements. 22nd November, 1957. (838247.)

36548. A.E.I.-Hotpoint, Ltd.—Electrically driven spin drying machines. 27th October, 1958. (838151.)

36954. Pritchett & Gold & E.P.S. Co., Ltd.—Separators for lead-acid electric accumulators. 21st October, 1958. (838468.)

37113. Lange, E.—Electric safety fuses. 28th November, 1957. (838152.)

37375. Babcock & Wilcox, Ltd.—Superheater suspension in a tubulous vapour generator. 29th November, 1957. (837994.)

37633. Hawke, W.—Electric junction boxes. 1st December, 1958. (838156.)

38062. Siemens Edison Swan, Ltd.—Electro-acoustic transducers. 19th November, 1958. (838159.)

38872. United-Carr Fastener Corporation.—Panel assemblies for use in electrical apparatus. 13th December, 1957. (838673.)

39153. Trüb, Täuber & Co., A.G.—Generating of homogeneous static magnetic fields. 17th December, 1957. (838160.)

39448. Simon-Carves, Ltd.—Industrial furnaces. 19th December, 1957. (838161.)

39604. Egyesult Izzolampa es Villa-Mossagi R.T.—Gas-filled incandescent electric lamps. 20th December, 1957. (838562.)

40395. Aesup.—Electrically controlled tooth brush. 31st December, 1957. (838564.)

1958

34869. Svenska Turbin Aktiebolaget Ljungstrom.—Speed synchronisers for synchronising the speed of a prime mover with an electrical generator. 30th October, 1958. (838487.)

41472. General Electric Co.—Method of growing semiconductor crystals. 23rd December, 1958. (838770.)

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 22nd July:—

Diotron. No. 795,152. Class 7. Machines for use in the manufacture of electric lamps, radio valves, semiconductor devices, electronic tubes, vacuum flasks and scientific electrical and laboratory glassware.—M. M. Fox, Triumph House, 189, Regent Street, London, W.1.

Culinator. No. 801,972. Class 7. Electric food mixing machines.—Special Electrical Appliances (1959), Ltd., 108, Leith Walk, Edinburgh.

EAR (design). No. B797,617. Class 9. Sound recording, sound reproducing, radio and television instruments and apparatus, and electrical appliances included in Class 9.—Electric Audio Reproducers, Ltd., The Square, Isleworth, Middx.

Clarafon. No. 799,555. Class 9. Telephonic apparatus and instruments, and sound amplifiers.—Multitone Electric Co., Ltd., 12-20, Underwood Street, London, N.1.

Anotrol. No. 800,140. Class 9. Electrical and electronic apparatus and instruments.—De Havilland Propellers, Ltd., Manor Road, Hatfield, Herts.

Redifonic. No. 800,463. Class 9. Instruments and apparatus for the production, transmission, reception, amplification, detection, control and measurement, etc., of carrier wave, telegraphic, telephonic, television or acoustic frequency signals or for direction finding.—Redifon, Ltd., Carlton House, Lower Regent Street, London, S.W.1.

Speedylec. No. 790,687. Class 11. Steam boilers (not parts of machines).—Bastian & Allen, Ltd., Ferndale Terrace, Harrow, Middx.

Planlite. No. 798,622. Class 11. Electric and oil lamps and parts included in Class 11.—Lamp Manufacturing & Railway Supplies, Ltd., Vincent Works, Vincent Lane, Dorking, Surrey.

Miracoal. No. 799,063. Class 11. Electric fires which simulate coal fires.—Willet & Robinson, Ltd., Prentis Chambers, 39, Earl Street, Maidstone, Kent.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that dates for their functions do not clash with others already arranged

MONDAY, 11th JULY

London.—White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. "Aircraft Developments," by C. F. Bassett.

TUESDAY, 12th JULY

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Annual ladies' luncheon. Guest speaker, Norman Collins.

TUESDAY, 12th JULY to THURSDAY, 14th JULY

Harrogate.—Great Yorkshire Agricultural Show.

WEDNESDAY, 13th JULY

Eltham.—Eltham Green School, Queenscroft Road. A.S.E.E. South East London Branch. Annual general meeting and films.

THURSDAY, 14th JULY

Wimbledon.—Prince of Wales Hotel, 7.45 p.m. A.S.E.E. South West London Branch. "Development of Motor Control Centres," by P. Wyer.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Electricity Commission of New South Wales, Sydney. 8th August. Tertiary voltage isolated phase busbar assemblies for Sydney South substation. (E.S.B. 16641/60.)*

Postmaster General's Department, Melbourne. 30th August. Television line transmission and switching equipment. (E.S.B. 16644/60.)*

Electricity Trust of South Australia. 21st July. Three 2,000 kVA, 33 kV/445 V transformers. (E.S.B. 16646/60.)*

Belfast.—Northern Ireland Housing Trust. 21st July. Electrical installations in 108 dwellings at Banbridge (Glencar). Offices of the Trust, 12, Hope Street, Belfast.

Burma.—Union Purchase Board, Rangoon. 17th July. Insulators. (E.S.B. 17064/60.)* 20th July. Electric lamps. (E.S.B. 17185/60.)* Cable and copper wire. (E.S.B. 17186/60.)* House service meters. (E.S.B. 17183/60.)* Electric fans. (E.S.B. 17184/60.)* 21st July. Lampholders, fuse units and lightning conductors. (E.S.B. 17180/60.)*

India.—Bombay State Electricity Board. 18th July. Diesel generating sets. (E.S.B. 17068/60.)*

India Store Department, London. 8th August. Billet and die heating furnaces. (See this issue.)

Kanpur Electricity Supply Administration. 4th August. Two 16,500 gal/min c.w. pumps, pump-house equipment, travelling screens and valves. (E.S.B. 16660/60.)*

Director General of Supplies and Disposals, New Delhi. 19th July. Armoured cable. (E.S.B. 16665/60.)* 20th July. A.c.s.r. conductors. (E.S.B. 16664/60.)* Railway electrification insulators. (E.S.B. 16572/60.)* 28th July. Electric hoist blocks. (E.S.B. 17114/60.)*

Madras State Electricity Board. 8th August. Distribution type lightning arrestors. (E.S.B. 16663/60.)*

Kuwait.—Department of Electricity, Water and Gas. 14th September. Multicore pilot cable and acessories. (E.S.B. 17149/60.)*

Mildenhall (Suffolk).—R.D.C. 22nd July. Sewage pumping plant with electric motors, starters and accessories. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

New Zealand.—New Zealand Electricity Department. 20th September. 30,000 kVA, 110/33 kV transformer bank. (E.S.B. 17157/60.)* 29th November. Two 38,888 kVA generators. (E.S.B. 17156/60.)* Two 50,000 b.h.p. turbines. (E.S.B. 17155/60.)*

Auckland Electric Power Board. 29th July. 11 kV cable. (E.S.B. 17153/60.)*

Dunedin Electricity Department. 22nd July. Electric cable. (E.S.B. 17193/60.)* Transformers, ranging from 200 kVA to 750 kVA. (E.S.B. 17192/60.)* 12th August. P.v.c. and p.i. insulated copper cable. (E.S.B. 16642/60.)*

Nigeria. — Electricity Corporation of Nigeria. 30th July. Two 1,000 kW portable diesel alternator sets. (E.S.B. 16637/60.)*

Rhodesia and Nyasaland.—Rhodesia Railways Tender Board, Bulawayo. 27th July. Electric overhead travelling cranes. (E.S.B. 16657/60.)*

Salvador.—La Proveeduria General de la Republica, San Salvador. 15th July. Telephone cables. (E.S.B. 17003/60.)*

South Africa.—Union Tender Board, Pretoria. 27th July. Radio valves. (E.S.B. 17121/60.)*

Stockton-on-Tees.—Corporation. Electrical installation, Hardwick Girls' Modern School. Borough architect, 28, The Square.

Sudan.—Central Electricity and Water Administration. 20th July. 1,100 street lighting fittings and accessories. (E.S.B. 16698/60.)*

Sudan Railways Stores Department. 27th July. Lighting fittings. (E.S.B. 17197/60.)*

Thailand.—Royal Irrigation Department. 25th August. 230 kV transmission line. (E.S.B. 16668/60.)*

Wanstead and Woodford.—Corporation. 25th July. Colour corrected mercury street lighting installation. (See this issue.)

Wigan.—Corporation. 20th July. Electrical installations in 13 dwellings, Warrington Road site, Worsley Mesnes estate. (See this issue.)

Yugoslavia.—Invest-Import, Belgrade. 18th July. Transmitter-receivers and laboratory testing equipment. (E.S.B. 17035/60/I.C.A.)*

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* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

ORDERS PLACED

Hebburn-on-Tyne.—U.D.C. Electrical installations in four-storey maisonnettes, Station Road (£1,740).—Norman Robinson.

Peterborough.—Electrical work at new hospital for East Anglian Regional Hospital Board (£10,077).—Mann, Egerton & Co.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Abergele.—Houses (150); Middleton & Co., Ltd., Bank Street Works, Blackpool.

Billingham-on-Tees.—Five-storey block of flats, Low Grange estate (£72,000); Wimpey & Co., Ltd., contractors, Orchard House, Fenwick Terrace, Newcastle-on-Tyne.

Houses (63), Roseberry Road; E. Shaw, U.D.C. surveyor.

Bingley.—Flats (36), Bradford Road; surveyor and architect, Town Hall.

Birmingham.—Dwellings (233), Kingshurst Hall estate; Morris & Jacombs, Ltd., 71, Hobmoor Road.

Cambridge.—Works and offices; Cambridge Daily News, Ltd., St. Andrews Street.

Cardiff.—Factory, Pengam Moor, for Rover Co., Ltd., Coventry; Hasker & Hall, architects, Longdon House, High Street, Knowle, Warwicks.

Carlisle. — Television centre, Durranhill industrial estate, for Border Television, Ltd.; E. M. Lawson, architect, Barras Buildings, Barras Bridge, Newcastle-on-Tyne.

Darlington.—Factory, McMullen Road trading estate, for C. H. Pugh, Ltd.; E. Gordon Crofts, architect, 49, Grange Road.

Dewsbury.—Seven-storey showrooms and offices, Wakefield Road; M. Harrison & Co., Ltd., Post Hill Quarries, Farnley, Leeds.

Easington.—Houses (75), King's Road, for R.D.C.; R. R. Lumsden, surveyor.

Eastbourne.—Block of flats, Blackwater Road; Sir John Brown, A. E. Henson & Partners, 117, Sloane Street, London, S.W.3.

Eccles.—Three-storey flats, Nelson Street area; Frank Bradley, architect, 4, Wood Street, Bolton.

Eston.—Houses (204), Church Lane estate; U.D.C. surveyor.

Exeter.—Nursing home for Nuffield Nursing Homes Trust, Ltd.; Beard, Bennett & Wilkins, architects, 101, Baker Street, London, W.1.

Flint.—Houses (87), Pen Goch; borough engineer, Municipal Offices, Earl Street.

Gloucester.—Extensions to Gloucestershire Training College of Domestic Science (£371,939); county architect, Shire Hall, Gloucester.

Grimsby.—First stage of new fire station; county architect, Lincoln.

Swimming baths (£267,000); Taylor & Coulbeck, Ltd., Cleethorpes.

Hailsham.—Three-storey offices, Deer Paddock, for East Sussex River Board; clerk to the Board, 1, Upper Lake, Battle, East Sussex.

Hounslow.—Development of site in High Street for F. W. Woolworth & Co., Ltd.; H. Winbourne, chief architect, Woolworth House, Marylebone Road, London, N.W.11.

Keynsham.—Shops and offices, Bath Hill area; surveyor, Council Offices, Keynsham, Bristol.

Leicester.—Major extensions to College of Art and Technology; J. H. Lloyd Owen, city architect, 10, Loseby Lane.

Middlesbrough.—Hotel (200 bedrooms), six shops, restaurant, etc., Marton Road, for M.D.M. Investments, Ltd.; J. Fullerton & Tusler, surveyors, 142, Wigmore Street, Portman Square, London, W.1.

Flats (61), Beechwood; J. A. Kenyon, borough engineer.

Department of physical medicine at Middlesbrough General Hospital; Newcastle Hospital Board, Benfield Road.

Newcastle-on-Tyne. — Central Library, Saville Place, for City Council (£485,000); city architect, 18 Cloth Market.

Houses (114), Newbiggin Hall estate; city architect.

Northumberland.—Proposed South East Northumberland Technical College (£300,000); R. W. Bell & Co., builders, Jesmond, Newcastle-on-Tyne.

Oxford.—Baptist church, Crowell Road, Cowley; Peter J. Reynolds, architect, 33, Little Clarendon Street.

Portsmouth.—Factory and offices, Fitzherbert Road, Farlington; G. Hall & Co., Ltd., Froddington Road, Southsea.

Redcar.—Houses (491), neighbourhood unit site; K. W. Ash, borough engineer.

Southampton.—Faculty of Arts building and theatre at University; Basil Spence, architect, 48, Queen Anne Street, London, W.1.

South Shields.—Three-storey block of shops, Fowler Street and Thomas Street, for the Arndale Property Trust, Bank Street, Bradford; G. H. Baxter, staff architect.

Garage, showroom and filling station for South Shields Carriage & Motor Co.; J. H. Morton & Son, architects, Martins Bank Chambers, Fowler Street.

Tynemouth.—Houses (147) and eight flats, Chirton Grange East; borough engineer, 16, Northumberland Square, North Shields.

Washington (Co. Durham).—Flats (28) and houses (61), Village Lane; U.D.C. surveyor.

Watford.—Office block, 41/43, Clarendon Road; Chaucer Estates, Ltd., 51, Piccadilly, London, W.1.

Whickham (Co. Durham).—Houses (14), flats (13) and maisonnettes (38), Athol Street; Fennell & Baddiley, architects, Bridge End Chambers, Chester-le-Street.

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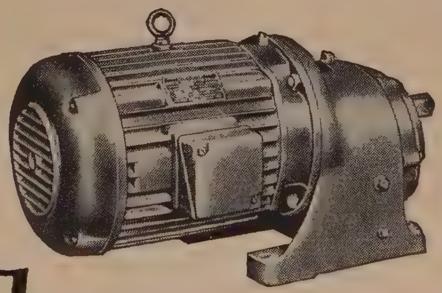

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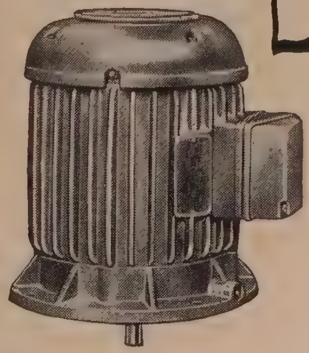

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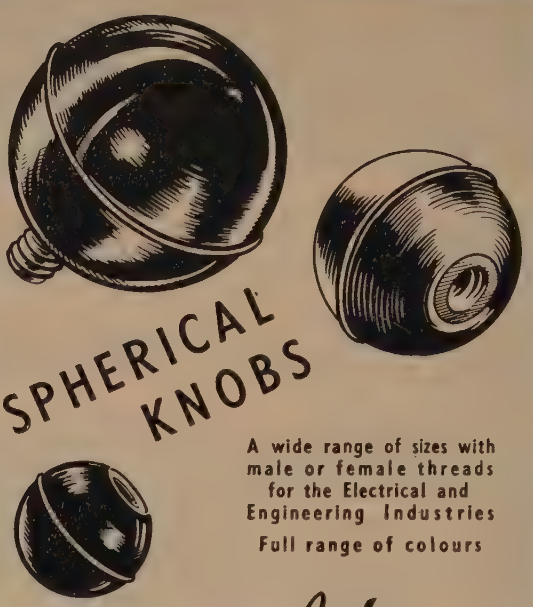

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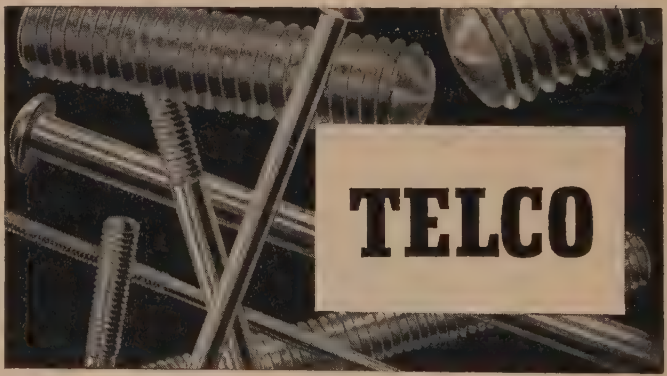

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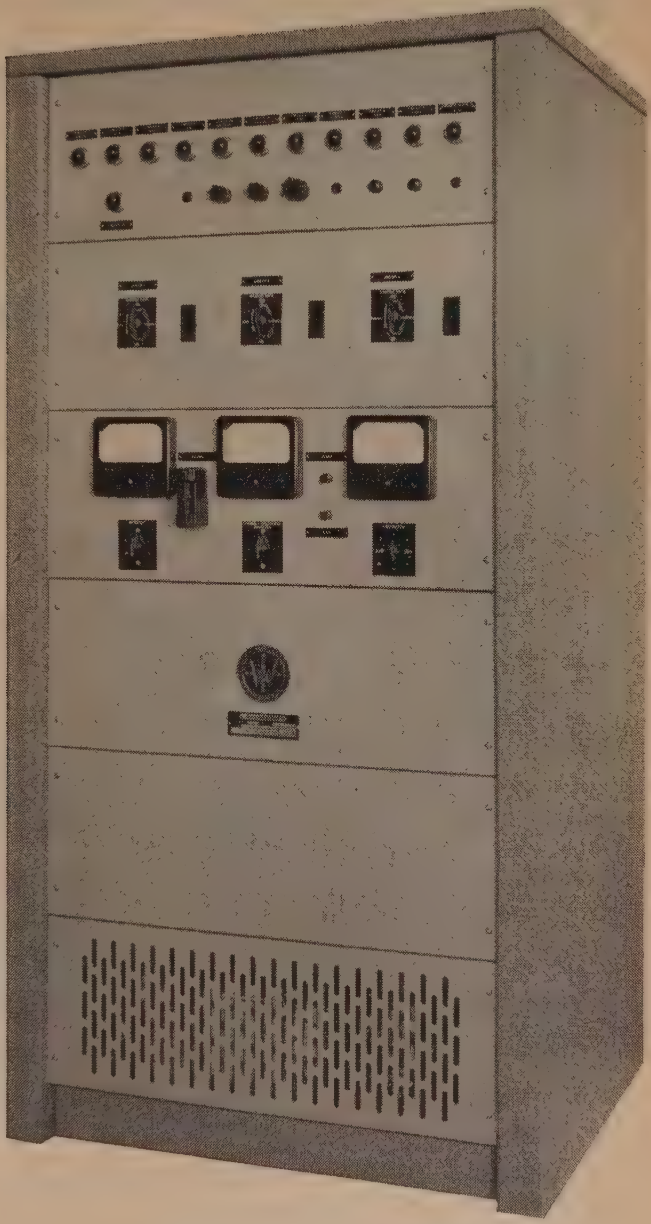

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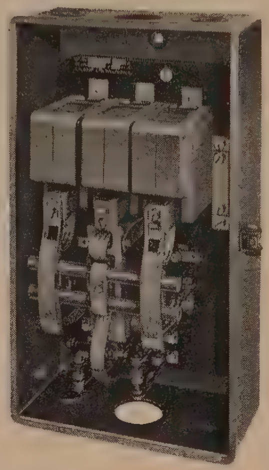

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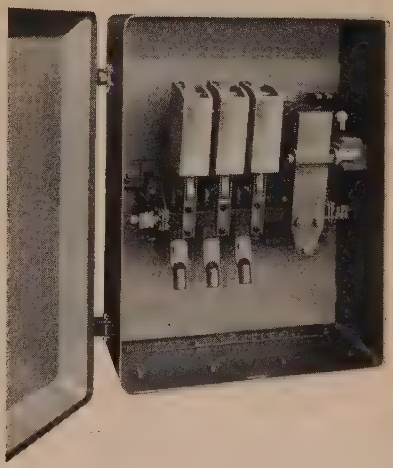

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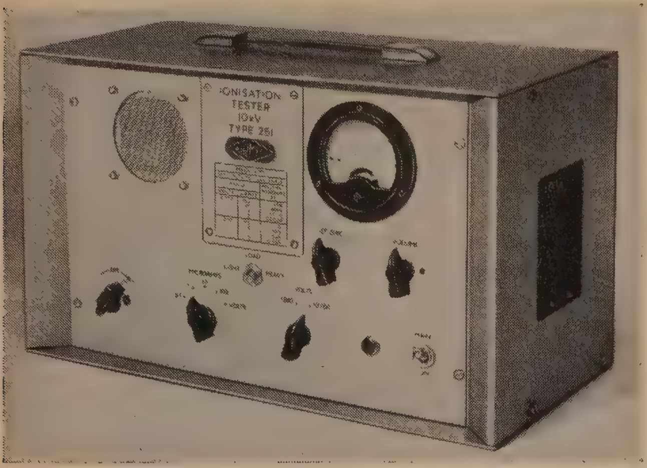

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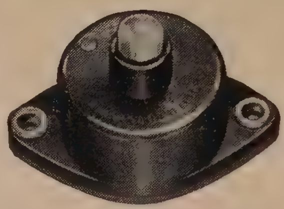

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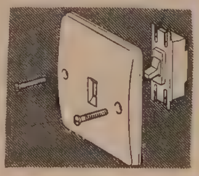

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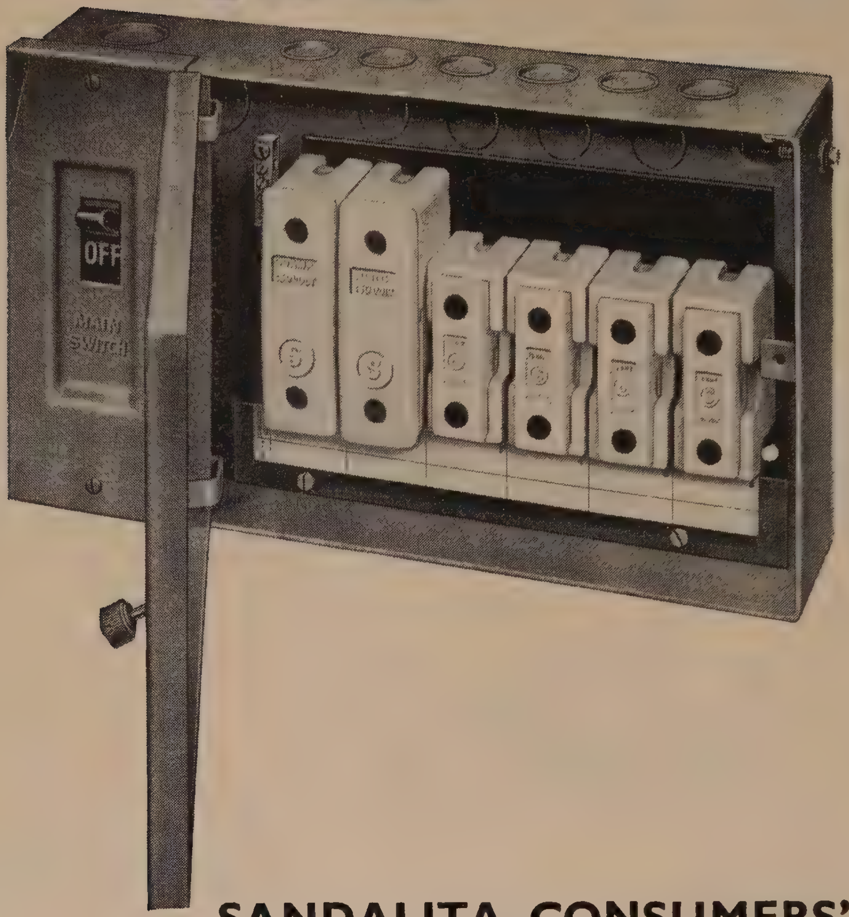

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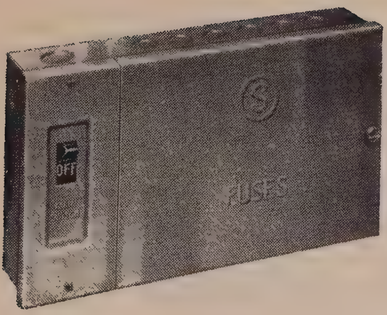

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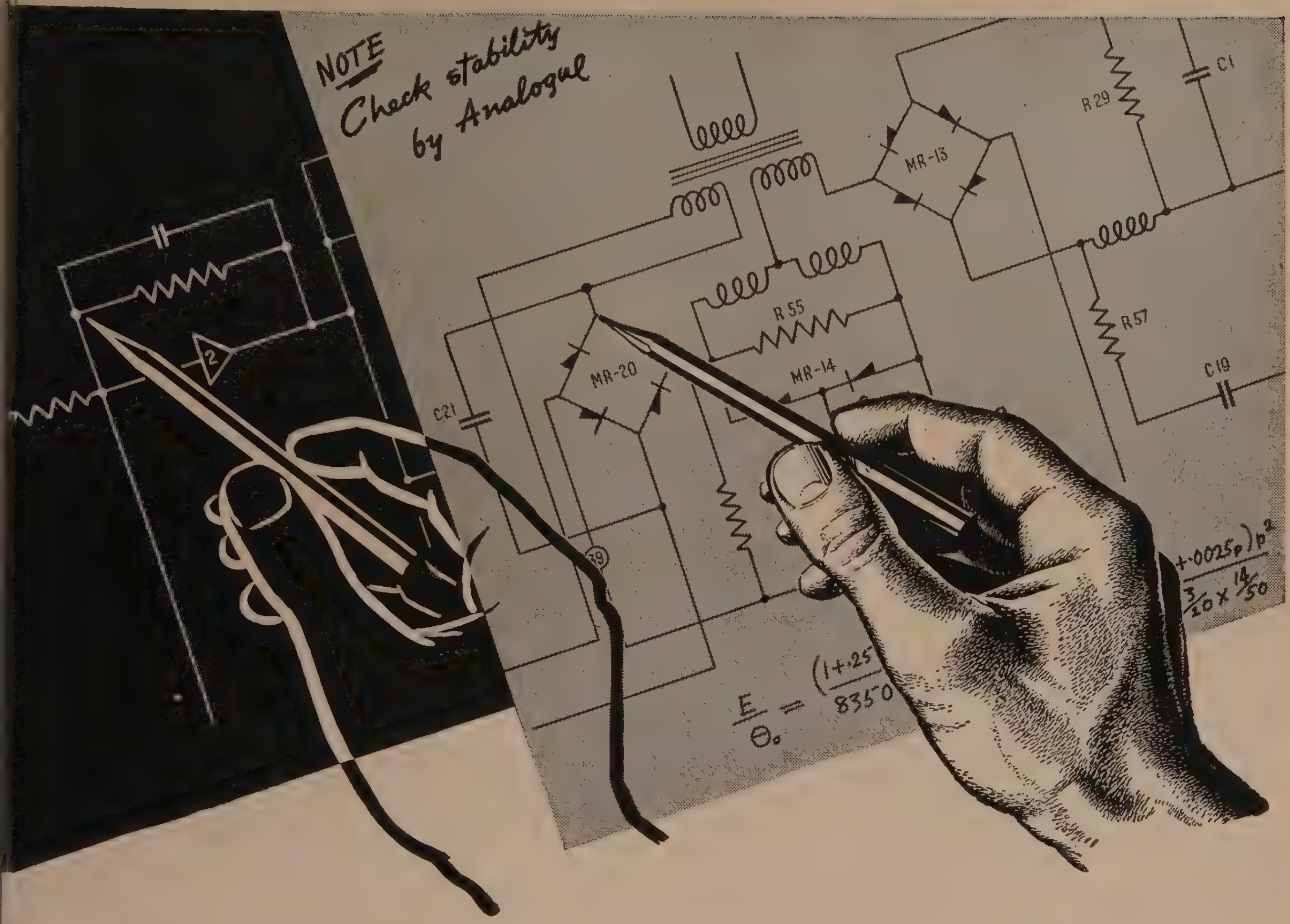

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1A

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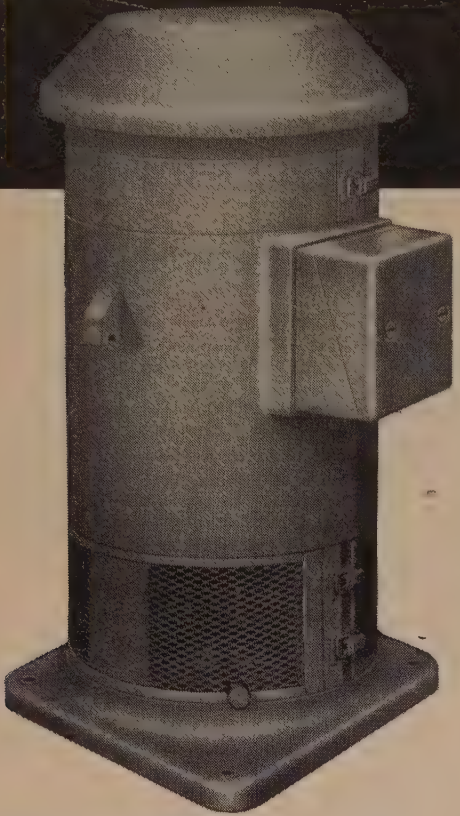

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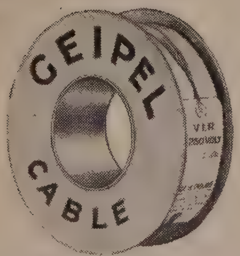

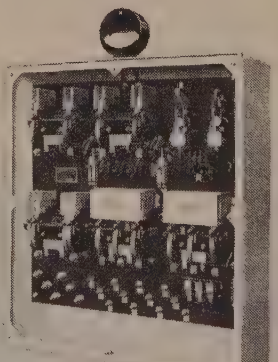

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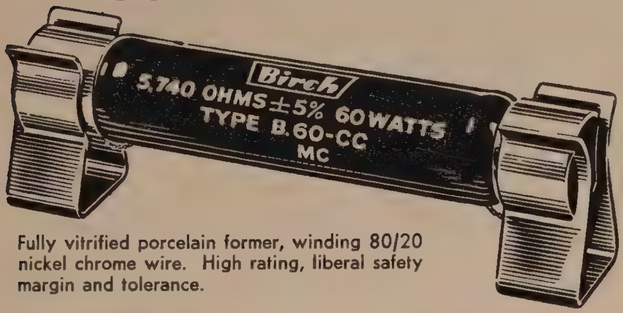

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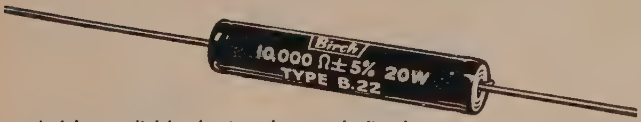

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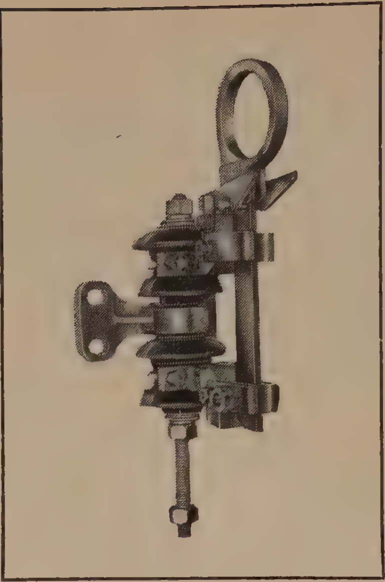

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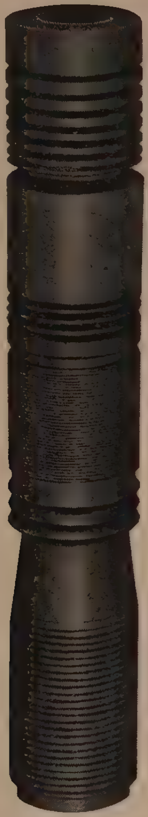

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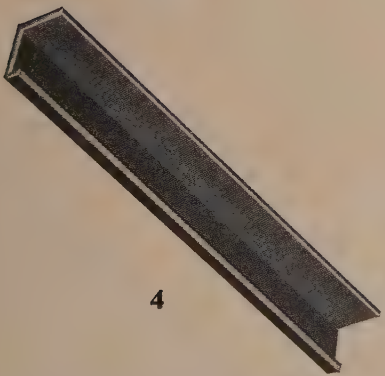

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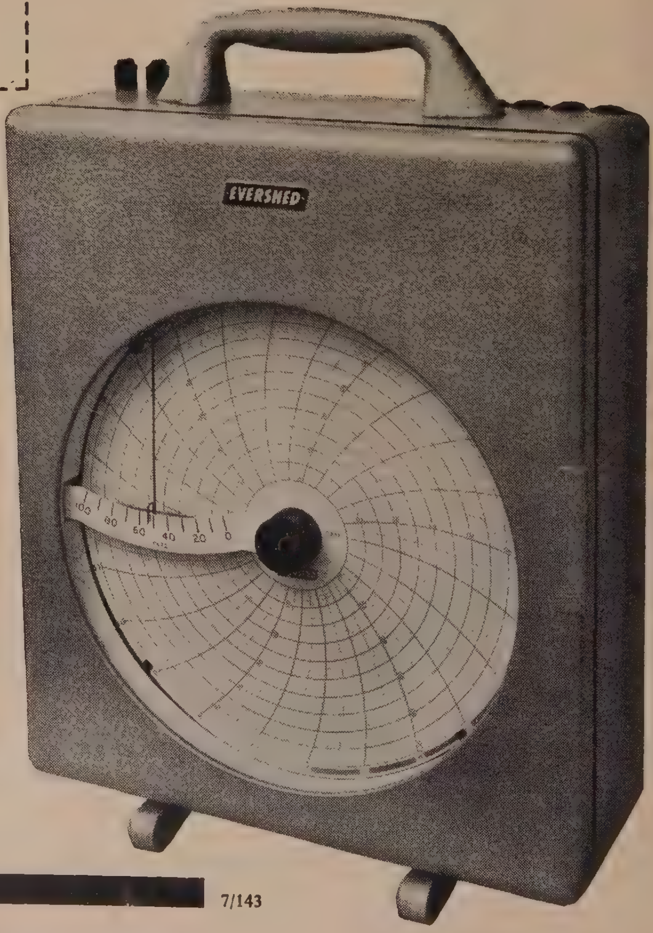

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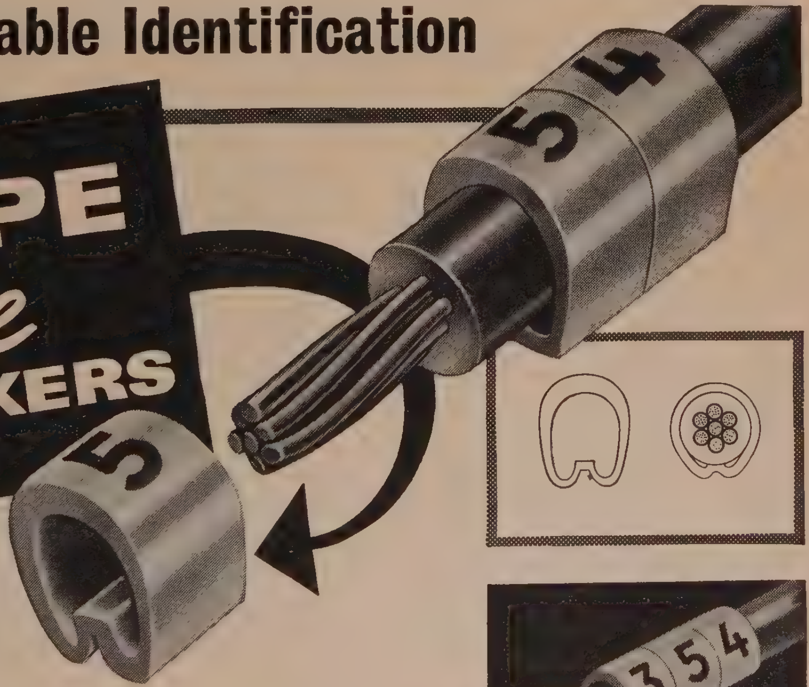
The Z-TYPE Flexible CABLE MARKERS



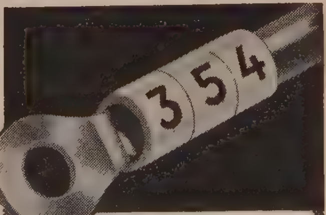
★ Grips the cable firmly.

★ Any number of markers can be used according to the code required.

★ Standard markings are figures 0-9 and letters A-Z, also a range of symbols.

★ Positive grip ensures markers remain permanently aligned.

★ NO TOOL REQUIRED FOR FITTING.



When used with compression-type terminations, the marker can be slipped over the shank to provide insulation protection.

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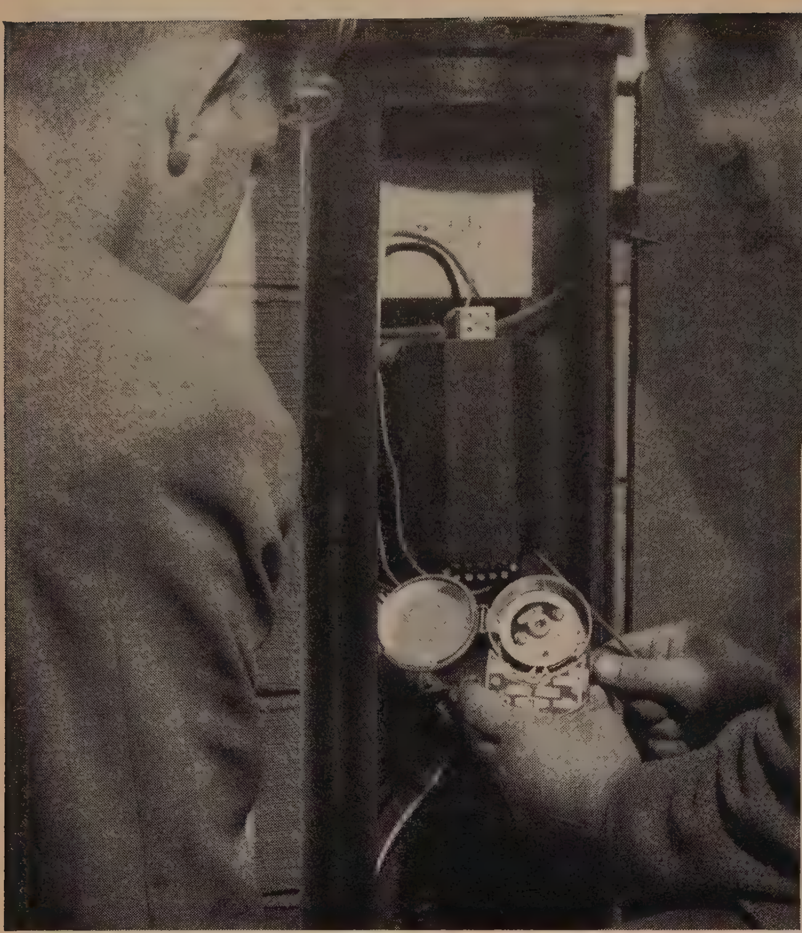

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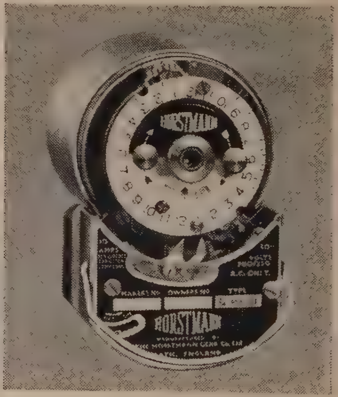
Horstmann– the automatic choice for lighting control

Once set and installed Horstmann Time Switches can be practically forgotten for they will operate unfailingly under varying conditions of service with very little attention. In addition absolute accuracy is ensured by the use of high grade materials coupled with careful craftsmanship—craftsmanship born of over 50 years experience in the design and manufacture of these instruments. Naturally, in the production of precision equipment, cost is not the most important consideration, yet despite their superiority, Horstmann Time Switches compare favourably in price with instruments not quite in the same class.
The large range of Time Switches which Horstmann make are used for many different applications, notably for the control of street lighting, shop window lighting, electric signs, and special tariff schedules—in short wherever electric current needs to be controlled automatically.
Full details of all models will be sent on request.

Once set, this solar compensating dial will automatically operate its correct lighting and extinguishing schedule.



The Type Q Mark III Time Switch is a two circuit midnight reduction model with 10 amp A.C. capacity per circuit.

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Horstmann Time Switches for controlling things Electrical

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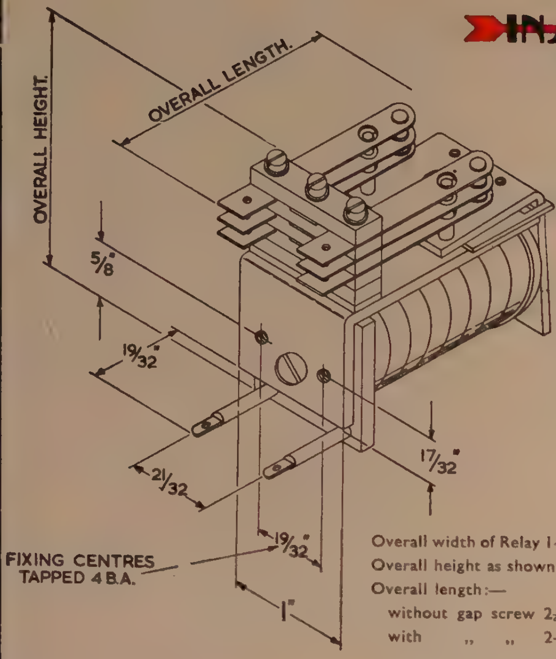
Newbridge Works, Bath • Telephone No. 7241

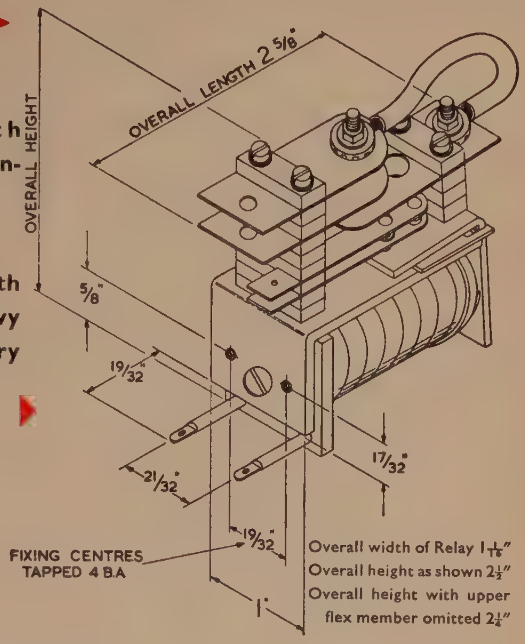
HG 7

INSTANTA RELAYS



Type SE with double pole contacts.

Type SE/H with single pole heavy duty and auxiliary contacts.



Overall width of Relay 1$\frac{1}{16}$"
Overall height as shown 2"
Overall length:—
without gap screw 2$\frac{1}{4}$"
with ,, ,, 2$\frac{7}{16}$"

Overall width of Relay 1$\frac{1}{16}$"
Overall height as shown 2$\frac{1}{2}$"
Overall height with upper flex member omitted 2$\frac{1}{4}$"

Switching capacity at 250 volts AC or 24 volts DC:—
Type SE—5 to 8 amps under appropriate conditions.
Type SE/H—25 amps under appropriate conditions.
Both types—coils for up to 250 volts AC or 110 volts DC.
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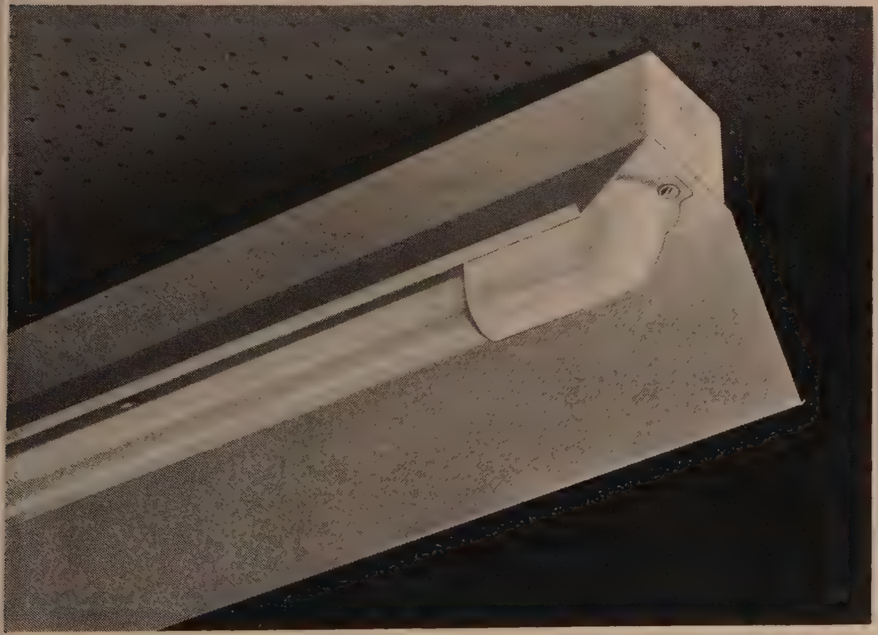

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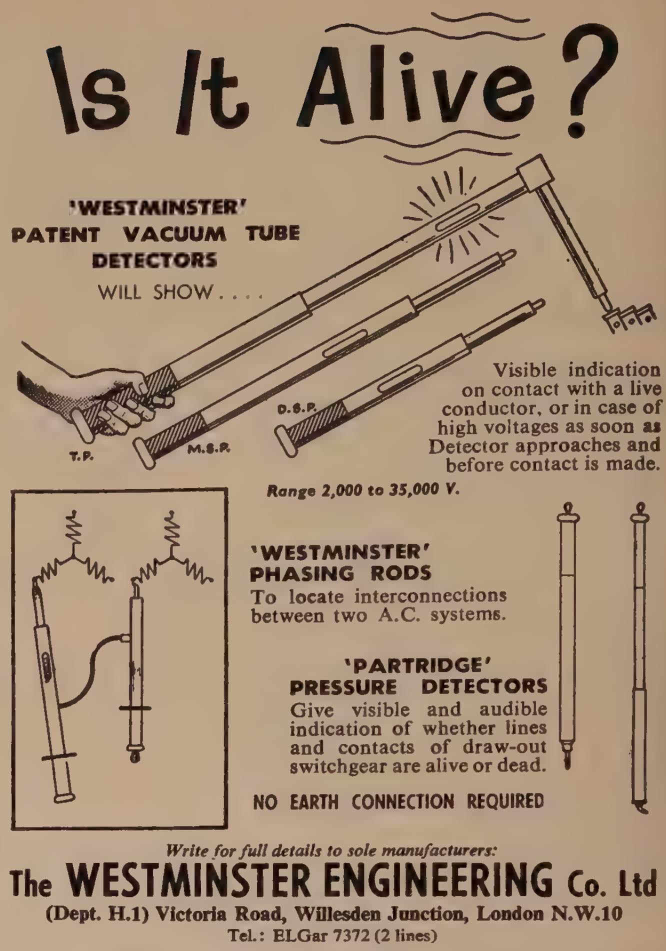

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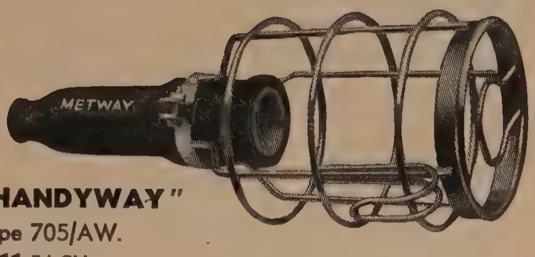

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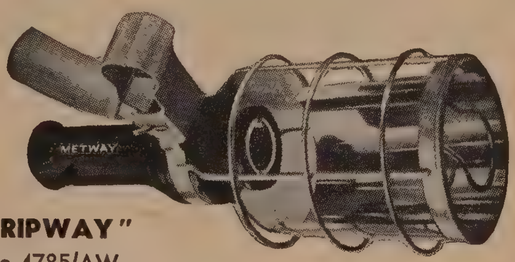

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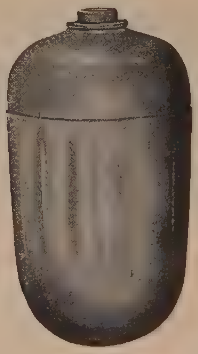

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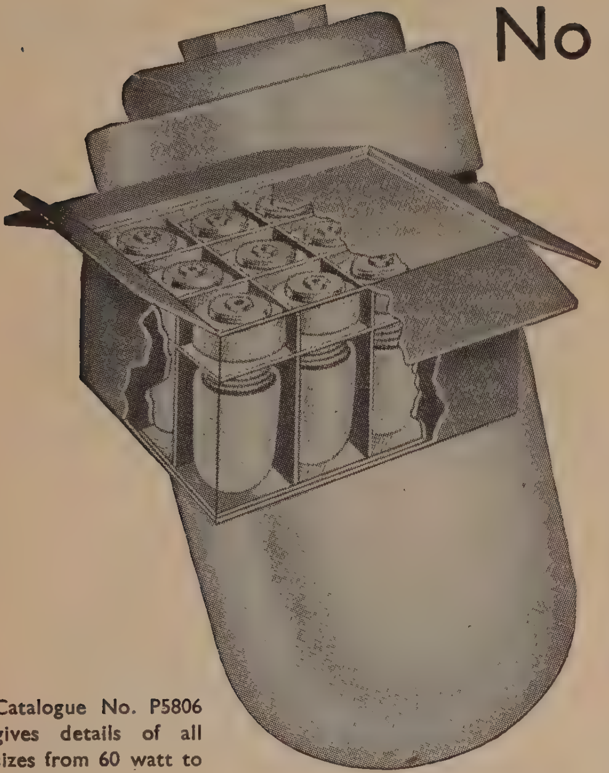

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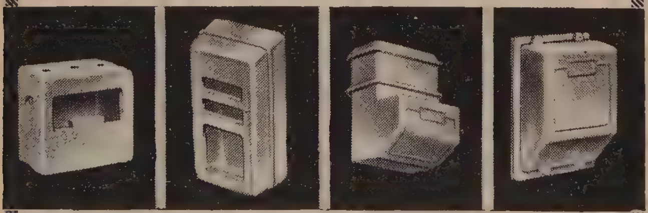

DEANS HAVE CAPACITY FOR QUANTITY—PRODUCTION AVAILABLE IN MOST MODERN FACTORY

Enormous strength, high insulation properties, resistance to corrosion and adaptability for producing complex shapes all combine to make Fibreglass-Reinforced Plastic ideal for switchboxes, control gear housing, switchcovers, etc. Deans specialise in the production of these, by the matched-metal die process, which ensures good surface finish and close working tolerances.

Deans technicians will be glad to advise on any technical matters concerning fibreglass applications—or to receive enquiries for repetition work.

Deans

DEANS & SON (YORKSHIRE) LTD.
Beverley, Yorkshire, England
A member of the Manganese Bronze Group

BCA

TRADE **TUNION** MARK

WALL BRACKETS

We offer you a wide selection of artistic plastic wall brackets designed to meet fully the present-day requirements for home furnishing and for commercial premises.

TMB/161

TMB/161. This E.S. Type is available either with or without pull switch and can also be supplied for exposed lamp.

TMB/158. This B.C. type takes a standard shade with 1⅛″ hole. It can be supplied with or without pull switch and also for inverted lamp to face upwards.

TMB/158

The above types can be supplied in BROWN. Both types available BC and ES.

Further types of wall brackets are detailed on page 20 of our 34 page illustrated Brochure 1453/ER and you are invited to apply for a copy. The Brochure also gives information of over 400 Tunion products.

GEORGE TURNOCK LTD

Tunion Works, Navigation Street, WALSALL, Staffs
Telephone: Walsall 4966

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words).

DISPLAYED CLASSIFIED:—48/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, C/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If displayed with boxed rules; name or symbol block by **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

COUNTY BOROUGH OF WIGAN

13 Dwellings, Warrington Road Site
Worsley Mesnes Housing Estate

TENDERS are invited from experienced Electrical Contractors for the complete wiring installations of 13 dwellings on the Worsley Mesnes Housing Estate.

The specification and particulars of the electrical installations can be obtained on application to the Borough Engineer, Municipal Buildings, Hewlett Street, Wigan, on payment of a deposit of £1 1s. (cheques payable "Wigan Corporation"), which will be returned on receipt of a bona fide tender.

Sealed tenders, endorsed "Tender for Electrical Installations, 13 Dwellings, Worsley Mesnes," must be delivered to the undersigned in the official envelope provided, not later than 10 a.m. on Wednesday, the 20th July, 1960.

The Corporation does not bind itself to accept the lowest or any tender. The contract will be subject to the Council's Standing Orders in respect of contracts which include a requirement for the provision of sureties.

ALLAN ROYLE,
Town Clerk.

Municipal Buildings,
Wigan.

5127

INDIA STORE DEPARTMENT

THE Director General, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

TENDER REF. 20018/60, 20019/60, 20020/60./NEN/HAL.2

Billet and Die Heating Furnaces, temp. range 750°C.-1,250°C. various sizes, one bath type, four batch types and one bogie hearth type, for use on 400/440 volts, 3-phase, 50 cycles supply.

The tender forms with schedules and specifications which are returnable on Monday, 8th August, 1960, may be obtained from the above office (CDN Branch) on payment of a fee of ten shillings (not returnable) for each tender.

The applications for tender forms should clearly state the above reference number. 5115

BOROUGH OF WANSTEAD AND WOODFORD

Snakes Lane Street Lighting Scheme
Groups "A" and "B"

TENDERS are invited for the installation of colour corrected mercury street lighting systems in Snakes Lane East (Group "A"), Snakes Lane West (Group "B") and The Broadway (Group "B"). The works include taking down existing short gas columns, provision and erection of new equipment and appurtenant works.

Tender documents may be obtained from the Borough Engineer, Municipal Offices, Woodford, London, E.18, upon payment of £2 deposit, returnable on receipt of a bona fide tender by noon on Monday, 25th July, 1960. 5142

CLASSIFIED ADVERTISEMENTS ARE PREPAID

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY PRODUCTION GROUP

require a

FUEL LIAISON ENGINEER

for the Sales Department, Commercial Directorate, to be responsible to a Fuel Contracts Engineer for liaison duties in connection with the administration of fuel supply contracts for nuclear power stations. Although the post is located at Risley, Near Warrington, the successful candidate must be prepared to spend an appreciable amount of time at nuclear power station sites.

Applicants must have served a recognised engineering apprenticeship and be Corporate Members of a Senior Engineering Institution, or hold equivalent qualifications in the Mechanical or Electrical Engineering field. Extensive experience in a large works organisation, preferably associated with some aspect of conventional fuel supply, is also required.

SALARY £1,370-£1,825 p.a. according to qualifications and experience.

Contributory superannuation. Staff housing scheme.

Send POSTCARD for application form, quoting reference P.141R/J7, to Staff Officer, United Kingdom Atomic Energy Authority, Production Group Headquarters, Risley, Warrington, Lancashire.

Closing date, 25th July, 1960.

5112

ENGINEERING DESIGNER-DRAUGHTSMEN

AIR MINISTRY Works Designs Branch requires in LONDON and PROVINCES ENGINEERING DESIGNER-DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution.

Candidates should have served recognised apprenticeship or had equivalent training and also have had practical experience. O.N.C. an advantage. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. 5-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted.

Salary in LONDON ranges from £680 (at age 25) to £900 p.a. for men; from £673 to £868 for women. Somewhat lower in PROVINCES. Commencing salary dependent on age, qualifications and experience.

Applicants, who must be natural-born British subjects, should write to Air Ministry, W.G.d, Lacon House, Theobalds Road, London, W.C.1, or apply to any Employment Exchange quoting Kings Cross 896, giving age, details of training, qualifications, full particulars of former posts held and copies of any testimonials. Candidates selected will normally be interviewed in London and certain expenses reimbursed. 252

British Railways (Southern Region)

require

ELECTRICAL ENGINEERING TECHNICAL ASSISTANTS

in the LONDON AREA for work connected with power supply and distribution. Knowledge of remote supervisory control equipment; switchgear and rectifier equipment, and/or high and low voltage cables and/or overhead lines will be of particular advantage.

Applicants should have had a sound technical training, having reached Higher National Certificate standard in Electrical Engineering or equivalent.

Salary range £875 p.a. to £948 p.a.

Application forms may be obtained from the Chief Mechanical and Electrical Engineer, British Railways, Southern Region, 15, St. Thomas Street, London Bridge, London, S.E.1.

5143

BAHRAIN STATE ELECTRICITY DEPARTMENT REQUIRE A MAINTENANCE ENGINEER

MINIMUM qualification H.N.C. in Electrical Engineering.

Salary payable in rupees equivalent to £1,575 rising to £1,890 a year.

Age preferably 28 to 35. Man required with power station experience with bias towards instrument overhaul and circuit testing, must be prepared to do shift work for approximately the first twelve months.

Duties include the electrical maintenance of gas turbine engine driven generating sets, 11 kV switchgear and all associated auxiliaries.

Contract for two years in first instance.

Kit and baggage allowance £60. Gratuity at rate of one month's salary for each year of service. Liberal leave on full salary. Free passages for officer, wife and two children under 18 years.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50960/EF. 5135

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPLICATIONS are invited for the appointment of MAINTENANCE ENGINEER (Mechanical) at Rugeley Power Station.

The successful applicant would be directly responsible to the Maintenance Superintendent for all mechanical maintenance on the station.

Candidates should have served a recognised apprenticeship and have had experience with the maintenance of large modern turbines, P.F. fired boilers and coal and ash handling plant.

Supervisory experience and good organising ability is essential, and the possession of technical qualifications to the standard of H.N.C. (Mech.) would be an advantage.

Salary to be in accordance with N.J.B. Schedule A, Grade 6, Class L, £1,340-£1,515 per annum.

Apply, quoting Vacancy Number 164/60MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs., to whom they should be returned not later than 22nd July, 1960. 5132

Situations Vacant *(continued)*

NORTH WESTERN ELECTRICITY BOARD

Senior Assistant Engineer
(Agricultural Development)
Commercial Department
Area Board Headquarters
Cheetwood Road, Manchester, 8

Applicants should have a sound knowledge of uses of electricity in agriculture and horticulture. The duties are primarily concerned with acting as a specialist adviser on such applications and maintaining contact with agricultural interests throughout the area. A sound knowledge of practical farming is desirable. Preference will be given to applicants possessing technical qualifications either in engineering or agriculture.

Salary scale £1,365-£1,730 p.a. Grade BX.3. N.J.B. conditions.

Applications on forms obtainable from and returnable to the Secretary, North Western Electricity Board, Cheetwood Road, Manchester, 8, by 25th July, 1960.

Demonstrator
Central District, Manchester

Applicants should be experienced in demonstrating all types of domestic electrical equipment and commercial catering equipment, to public audiences, in service centres and on consumer's premises; they should hold the E.A.W. Certificate in Electrical Housecraft.

Salary scale £600-£700 per annum. Grade 1. N.J.C. conditions.

Fourth Assistant Engineer (Contracting)
Sub-Area Commercial Department, Manchester

Applicants should have experience in the control and supervision of all classes of contract wiring, preparation of estimates and specifications, supply of information to all classes of consumers on electricity utilisation tariffs, also the preparation of space heating schemes, etc.

Salary scale £890 × £20 to £990 per annum. Grade M.13. N.J.B. conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 18th July, 1960.

Demonstrators
Blackburn District

Applicants should be experienced in the demonstration and sale of electrical appliances within service centres and to audiences elsewhere. Duties will include general assistance in service centre work. The possession of a suitable qualification is desirable.

Salary scale £600-£700 per annum. Grade 1. N.J.C. conditions.

Applications on a form obtainable from and to be returned to Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, by 18th July, 1960. 5146

SMITHS AVIATION DIVISION

at CHELTENHAM, GLOS.

require a

DEVELOPMENT ENGINEER

to work on the design and development of miniature precision A.C. motors and synchros for servo-mechanisms.

Applicants should possess a Degree of H.N.C. in Electrical Engineering or equivalent. A good theoretical background and development experience on A.C. machines is required.

Write giving full particulars of age, previous experience, qualifications, present salary and salary envisaged to the

Divisional Personnel Manager
S. SMITH & SONS (ENGLAND) LIMITED
Bishops Cleeve
Nr. Cheltenham, Glos

4929

ASSISTANT DEVELOPMENT ENGINEER
(Electrical)

A RAPIDLY expanding company, engaged in the manufacture of small switches and electro-mechanical assemblies, requires a keen, enthusiastic and ambitious engineer for the investigation, original design, development of new products, streamlining of existing ranges and supervision of electrical testing activities. He should be 25-30 years of age, have served an apprenticeship (electrical), hold H.N.C. or equivalent qualification, and will be directly responsible to the Technical Manager.

Apply in confidence, providing full details of education and experience to:—

Technical Manager
D. H. BONNELLA & SON LTD.
West Hill, Hoddesdon, Herts

5137

THE DE HAVILLAND ENGINE COMPANY LIMITED
INDUSTRIAL PRODUCTS DIVISION

A vacancy exists for an

ELECTRICAL TECHNICAL ASSISTANT

with practical experience on the preparation of wiring diagrams, printed circuitry, transistor amplifiers, and Buxton requirements.

Applicants with electrical training up to at least O.N.C. standards and experience in any of the services could be suitable candidates for this vacancy.

Written applications should be sent to :—

The Personnel Officer (Ref. SC.995)
THE DE HAVILLAND ENGINE COMPANY LIMITED
Leavesden, Nr. Watford, Herts

5157

TRANSFORMER DESIGNER

for transformers and L.F. chokes

(a) Laminated and 'C' Core pattern up to 5 kVA.

(b) Power transformers up to 500 kVA.

Salary according to age and experience. 5-day week. Contributory pension scheme.

Apply:

WILLESDEN TRANSFORMER COMPANY LTD.
Manor Park Road, London N.W.10
(Elgar 5445)

309

COMMISSIONING ENGINEER

A COMMISSIONING engineer with H.N.C. must be capable of carrying out full commissioning testing of H.T. and E.H.T. switchgear. Must be fully conversant with primary, secondary, injection testing, pressure testing, also Merz Price, Translay Impedance, etc., testing.

Applications giving full particulars of age, experience, etc., to the Personnel Manager, South Wales Switchgear, Ltd., Blackwood, Mon. 5096

SOUTH WALES ELECTRICITY BOARD

District Commercial Engineer

Applications are invited for an appointment as DISTRICT COMMERCIAL ENGINEER in the Pontypridd and Caerphilly District of the Cardiff and East Central Area of the Board.

The salary for the position will be in accordance with Scale 13 (£1,245/£1,410) of the Common Salary Scale of the National Joint Board Agreement for the Electricity Supply Industry.

The District territory contains the Urban District Councils of Pontypridd, Caerphilly, Bedwas and Machen, together with portions of two adjoining Rural District Councils. The area totals 58 sq. miles. Of electricity supplied to 26,000 consumers, 80% is for industry.

Prospects of development are good, both for industrial expansion in the District and for commercial and domestic expansion. The Eastern sector of the District is becoming a "dormitory" area for the influx of workers to the industrial projects at Llanwern Steelworks and an intended Car Factory at Cardiff.

The District Office is at Pontypridd and the successful candidate will be required to live reasonably close to the District Office.

Applicants should preferably be Chartered Electrical Engineers.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, Assoc.I.E.E., Manager, Cardiff and East Central Area, 445/447, Cowbridge Road East, Cardiff, so as to arrive not later than Saturday, 23rd July, 1960. Envelopes should be marked "District Commercial Engineer, 133/60."

Mechanical Workshop Instructor

Applications are invited for the position of MECHANICAL WORKSHOP INSTRUCTOR in the Board's Apprentice Training School, Newport Road, Cardiff.

The salary for the position will be in accordance with Grade 4 (£795/£870) or Grade 5 (£885/£960) of the National Joint Council (Administrative and Clerical Grades) Agreement for the Electricity Supply Industry, and the precise duties of the post will be decided according to the qualifications and experience of the successful applicant.

The successful applicant will be required to give instruction to apprentices in workshop practice with emphasis on the correct use of hand tools and elementary instruction on machine tools. He will also be required to lecture on related subjects.

The possession of the Ordinary National Certificate in Mechanical Engineering, or its equivalent, is desirable.

Applications stating age, present position, present salary, qualifications and experience should be addressed to the undersigned at St. Mellons, Cardiff, so as to arrive not later than Saturday, 23rd July, 1960. Envelopes should be marked "Mechanical Workshop Instructor, 134/60."

R. G. WILLIAMS,
Secretary.

5136

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

Third Assistant Engineer (Mechanical)

APPLICATIONS are invited for the position of THIRD ASSISTANT ENGINEER (Mechanical) at Uskmouth "B" Power Station Site.

Applicants should have had a fundamental training in mechanical engineering, including workshops and should preferably have experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Appropriate technical qualifications will be an advantage.

The salary will be in accordance with Schedule C, Grade 7, Scale 13, £1,090-£1,410 per annum of the National Joint Board Agreement.

Applications should be made on standard form AE6 available from the Administrative Officer, Midlands Project Group, P.O. Box No. 314, Birmingham, 30, and should be returned to him not later than 20th July, 1960.

Envelopes should be marked "Confidential," Staff Vacancy Notice No. MPG.49/60. 5134

'ENGLISH ELECTRIC'

FUSEGEAR DIVISION

who manufacture a wide range of switchboards and distribution equipment incorporating H.R.C. fuses, have a limited number of vacancies for experienced

SALES AND CONTRACTS ENGINEERS

at their Liverpool Works. These appointments command a good salary, are permanent and pensionable with life assurance benefits after a short qualifying period. There are excellent opportunities for promotion and advancement for keen young electrical engineers interested in making a career with the Company.

Outside Technical Representatives for both Home and Overseas territories are appointed from the inside Engineering staff from time to time, after completion of an initial period in the Works.

Qualifications required are H.N.C. or equivalent, together with sound practical training and experience in (a) industry, (b) electrical contracting or (c) electricity supply. Applications will also be considered from more junior engineers who are at present in the final year of study for the H.N.C. in Electrical Engineering but who do not have commercial experience. In such cases training will be given. Generous assistance with removal and housing expenses will be given to successful candidates. Please write giving full details of qualifications and experience to:

DEPT. G.P.S., MARCONI HOUSE, STRAND, LONDON, W.C.2

quoting reference ER 497E

282

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

DEMONSTRATOR required in the Wrexham District of the Board's No. 4 Sub-Area. Salary within range £600/£700 per annum (N.J.C. Grade 1).

Candidates should have a good knowledge of electrical appliances, and be competent to give demonstrations of cooking, laundering and housecraft subjects. The possession of a recognised Diploma in Domestic Science or other approved certificate desirable.

Possession of a valid motor vehicle driving licence would be an advantage.

Appointment subject to medical examination. Pension scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, Nr. Wrexham, or from any District Office. Closing date, 21st July, 1960.

5130

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Shin Generation Group

Vacancy for Group Control Engineer

APPLICATIONS are invited for the above post at Shin Generating Station. Minimum technical qualifications H.N.C. or equivalent and candidates should preferably have experience in power station operation and high voltage switchgear. A knowledge of hydraulics is also desirable.

Salary £890-£990 (N.J.B. F/7) plus 10% shift allowance. Superannuation scheme. A house to rent will be available to the successful applicant.

Applications, stating age, qualifications, experience, and whether married or single should be forwarded to the Generation Engineer, Shin Generating Station, Invershin, Sutherland, by 18th July, 1960.

5147

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Northfleet Power Station

ASSISTANT ENGINEER (Electrical) (Vacancy No. 144/60). Applicants should possess H.N.C. (Electrical) with both light and heavy current subjects. Duties will include maintenance, fault location and testing of a wide range of protection, electronics and heavy current equipment, together with supervision of general maintenance.

Salary N.J.B. Class M, Grade 10, £1,130-£1,265 per annum, including London allowance.

Applications giving age, details of qualifications, experience, etc., to Station Superintendent, Northfleet Power Station, Crete Hall Road, Northfleet, Kent, to arrive by 20th July, 1960.

W. H. DUNKLEY,
Divisional Controller.

5131

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Midlands and East Midlands Region

Research and Development Department

Appointment of Assistant Chemists

APPLICATIONS are invited for the under-mentioned appointments as ASSISTANT CHEMISTS within the Regional Research and Development Organisation:—

1. Vacancy No. MEM/80.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £990 per annum, (b) £1,055 per annum, (c) £1,130 per annum.

Two chemists are required initially for measurements and research work on air pollution. The duties will involve routine analyses, maintenance of instruments and assessment of instrumental analyses, at various points in the Trent Valley. The successful candidates will in the first instance be based in Nottingham and it is essential that the applicants should hold a current driving licence.

2. Vacancy No. MEM/81.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £1,215 per annum, (b) £1,305 per annum, (c) £1,410 per annum.

Two posts are available within the research organisation and will be based in Birmingham. One will be concerned with atmospheric pollution work and the successful applicant must be prepared to supervise field work; and he should, therefore, hold a current driving licence. He will also be required to undertake other more general duties within the Research Organisation as conditions demand.

For the second post the successful candidate will probably be required to undertake field work of a chemical nature in Power Stations.

The minimum qualification for these posts is the Higher National Certificate in Chemistry, but preference will be given, especially for the higher posts, to holders of university degrees or to those qualified for admission to the Corporate Membership of the Royal Institute of Chemistry.

Applications should be submitted on form AE6/ACT to the Assistant Regional Secretary (Personnel), 53, Wake Green Road, Moseley, Birmingham, 13, quoting the above Vacancy Numbers, to arrive not later than Saturday, 30th July, 1960. 5116

PROFESSIONAL ENGINEER

required at

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

to be responsible for technicians and skilled workers engaged on the installation, operation and modification of particle accelerators and similar major electro-mechanical plant. Duties involve interesting and novel design work in collaboration with scientific staff.

Applicants should have served a recognised engineering apprenticeship or have had equivalent training. An Engineering degree an advantage.

Several years' experience of medium power electrical engineering and familiarity with circuit techniques for sequential and semi-automatic control systems is desirable. Knowledge of high vacuum systems and basic mechanical engineering practice an asset.

Salary £860 (at age 25) to £1,340 p.a. or £1,370-£1,825 p.a. according to age and experience.

Housing and superannuation schemes.

Send POSTCARD for details to Personnel Manager (1730/48), U.K.A.E.A., A.E.R.E., Harwell, Didcot, Berks.

5109

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

APPLICATIONS are invited for the appointment of MAINTENANCE ENGINEER (Electrical) at Rugeley Power Station.

The successful applicant would be directly responsible to the Maintenance Superintendent for all electrical maintenance on the station.

Candidates should have had experience in the maintenance of modern power station electrical equipment and experience with hydrogen cooled alternators is desirable.

Supervisory experience and good organising ability is essential, and the possession of technical qualifications to the standard of H.N.C. (Elect.) would be an advantage.

Salary to be in accordance with N.J.B. Schedule A, Grade 6, Class L, £1,340-£1,515 per annum.

Apply, quoting Vacancy Number 165/60MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs., to whom they should be returned not later than 22nd July, 1960. 5133

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

ASSISTANT ENGINEERS (Operation) required at Hinkley Point Nuclear Power Station.

Superannuation scheme. Salary N.J.B. provisionally within Scale 11, £1,080-£1,215 per annum.

Following a short period of theoretical training, successful candidates will, initially, be employed on certain aspects of plant inspection and will ultimately be responsible for the operation, on shift, of a reactor and its associated generating plant.

Please quote Ref. ER.86/60.

Applications on form A.E.6/ACT obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 20th July, 1960.

ASSISTANT ENGINEER (Operation) required at Berkeley Power Station, Berkeley, Gloucestershire.

Superannuation scheme. Salary N.J.B. Class M, Grade 8, Scale 13, £1,245-£1,410 per annum.

Candidates should be Corporate Members of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers or hold equivalent qualifications, and must have had responsible experience in the operation of modern generating plants. Preference will be given to candidates having experience of plant testing.

The successful candidate will be responsible to the Operation Superintendent for testing and efficiency control of nuclear and conventional plant. Nuclear knowledge will be considered an advantage but is not essential as special training will be given to a suitable candidate to fit him for employment in a Nuclear Power Station.

Please quote Ref. ER.84/60.

Applications on form A.E.6/ACT obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 20th July, 1960. 5162

MK

M.K. ELECTRIC LIMITED

have the following vacancies in their Technical Drawing Office.

DESIGNERS—experienced in the design of small Electrical/Mechanical products for large-quantity manufacture.

DRAUGHTSMEN—with routine Drawing Office experience and preferably in connection with small Electrical products—preparing standard drawings, data sheets, etc.

PHOTO-PRINTING—an assistant (male or female) for the photo-printing and photographic section with previous photo-printing experience and a knowledge of industrial photography.

Excellent working conditions in a new Drawing Office. Five-day week of 37½ hours. Holiday arrangements honoured and attractive salaries offered according to experience.

Applications treated in strict confidence if addressed to :—

Technical Manager

M.K. ELECTRIC LIMITED

Shrubbery Road, Edmonton, London, N.9

5121

OVERSEAS CONTRACTS ENGINEER

A VACANCY exists for an experienced Electrical Engineer to take charge of installation and commissioning of cables, overhead lines, switchgear and transformers with associated administrative work. Previous supervisory experience essential. The work would be located in Nigeria and Ghana, the initial period of this tour being 18 months.

Applications giving full particulars of age, training and experience to:—

Employment Manager
JOHNSON AND PHILLIPS LIMITED
Victoria Way, Charlton, London, S.E.7

4971

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT

(i) THIRD ASSISTANT ENGINEER (170/60.R).

(ii) FOURTH ASSISTANT ENGINEER (171/60.R).

Candidates for (i) should have had experience in operation and maintenance of H.V. and L.V. overhead and underground systems (including substations), fault location and protection.

Candidates for (ii) should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary N.J.B. Class F, as follows :—

(i) Grade 9 (£800 - £875)
(ii) Grade 11 (£690 - £785)

Apply by letter within 14 days to the Manager, Great Yarmouth District, Eastern Electricity Board, Regent Road, Great Yarmouth, Norfolk.

Northmet Sub-Area

THIRD ASSISTANT ENGINEERS

(a) ST. ALBANS DISTRICT (Ref. 987) (169/60.R).

(b) EDMONTON DISTRICT (Ref. 988) (172/60.R).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems (including substations).

Salary N.J.B. Grade 9, as follows :—

(a) Class G (£845-£930)
(b) Class F (£800-£875) plus London allowance.

Apply by letter within 10 days as follows :—

(a) F. J. Drake, Assoc.I.E.E., Manager, St. Albans District, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, Herts.
(b) C. A. Baker, B.Sc.(Eng.), M.I.E.E., Manager, Edmonton District, Eastern Electricity Board, 305, Fore Street, Edmonton, London, N.9. 5167

STAFF OPPORTUNITIES AT OLD-ESTABLISHED ELECTRICAL DISTRIBUTORS

WILEC LTD.

invite applications for the following appointments :—

SALES MANAGER. Only those with considerable and varied experience in the electrical industry should apply. A really first-class opportunity for the successful applicant, who must have drive and initiative, be capable of taking full control of the sales staff, and be able to considerably augment sales of the company.

TRADE - COUNTER ASSISTANT. Excellent position for a man completely familiar with the domestic and industrial products of the electrical wholesale trade. Salary according to experience. 5-day week, hours 8.30 a.m. until 5.30 p.m. Holiday arrangements respected.

ORDER OFFICE CLERK. Good opportunity for experienced man. Duties include taking telephone orders, progress chasing, placing "specials" orders, assisting with the general running of the order office, etc. 5-day week, hours 8.30 a.m. until 5.30 p.m. Holiday arrangements respected.

SALES REPRESENTATIVES required to call on contractors, industrial users and retail dealers in the Greater London area. Experience essential. Good existing trade connection will be handed over.

ALL APPLICATIONS will be treated in the strictest confidence and should be addressed to the Managing Director, WILEC LTD., 90-96, City Road, London, E.C.1. 5158

EAPL

MAINS ENGINEERS

required for

KENYA COLONY

SENIOR MAINS ENGINEERS

Experienced in the design, construction, control, maintenance and operation of extensive networks (O.H. up to 66 kV, U.G. up to 33 kV), including substation layouts, network calculations, etc. Successful candidates will be expected to negotiate with consumers and handle European, Asian and African staff and prepare specifications and estimates of distribution schemes. Preference given to candidates of A.M.I.E.E. standard with supply industry experience. (Minimum age 30.)

MAINS ENGINEER

Conversant with construction, maintenance and operation of distribution networks, including surveying, profiling and estimating. Experience in street lighting erection and house wiring problems an advantage. Must be able to handle Asian and African staff. Preference given to H.N.C. (Elec. Eng.) candidates. (Minimum age 28.)

MAINS ASSISTANT

Knowledge of electrical engineering generally and possessing at least O.N.C. (Elec. Eng.) with experience in estimating, planning and erection of service lines. Duties will include climbing and inspecting O.H. lines (age 21-25).

The above vacancies offer progressive and permanent positions with initial emoluments, depending on age, qualifications and experience, in the following ranges:

Senior Mains Engineer	**£1,500 to £1,820**
Mains Engineer	**£1,320 to £1,500**
Mains Assistant	**£930 to £1,050**

- ★ **Free furnished housing and passages** ★ **Contributory Pension Scheme**
- ★ **Generous family medical benefits**
- ★ **Children's Education Allowance**
- ★ **Free Life Assurance and Widows' Pension Fund**

Apply in strict confidence, stating age, qualifications, experience, present position and salary to:—

THE LONDON SECRETARY

THE EAST AFRICAN POWER & LIGHTING CO., LTD.

BOW BELLS HOUSE, BREAD STREET (CHEAPSIDE),
LONDON, E.C.4

5128

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Dundee Area

APPLICATIONS are invited for the following posts at Carolina Port Power Station:—

SENIOR CHARGE ENGINEER. Experience is necessary in supervising, controlling and efficiently operating all aspects of power station equipment, together with ability to deal with shift-staffing matters.

Technical qualifications of Higher National standard are desirable.

Salary in accordance with Class F, Grade 7 (£910 × £15 to £955) of the National Joint Board Agreement, plus 10% shift allowance. Superannuation scheme.

ASSISTANT CHARGE ENGINEER. Experience is desirable in the synchronising the loading of large turbo-alternators, the switching and load distribution of systems of voltages up to 132 kV and in power station electrical plant generally.

Technical qualifications of Higher National standard are desirable.

Salary in accordance with Class F, Grade 9 (£815 × £15 to £860) of the National Joint Board Agreement, plus 10% shift allowance. Superannuation scheme.

Application forms are obtainable from the Area Manager, 7, Dudhope Crescent Road, Dundee, and should be returned by Friday, 22nd July, 1960. 5145

CENTRAL ELECTRICITY GENERATING BOARD

Clarence Dock Power Station, Liverpool

Development and Planning Engineer

(Vacancy No. E.117/329/R)

Applications are invited from Engineers of Higher National Certificate standard. The duties include long term planning of electrical and mechanical maintenance and of plant operation. Special investigations and frequent review of methods of work. Continuous appraisal of technical and financial operating results with particular attention being paid to any deviation from standard. Salary scale £1,340-£1,515 (N.J.B. K.5).

Shift Charge Engineer

(Vacancy No. E.117/330/R)

Applicants should possess H.N.C. in mechanical and/or electrical engineering and should have had experience in the operation of high merit plant. Salary scale £1,155-£1,305 plus 10% shift allowance (N.J.B. K.7).

Good pension, holiday and sick pay schemes.

Applications stating age, experience (and for Vacancy No. E.117/329/R names of two referees) should be sent to the Director of Labour and Welfare, Central Electricity House, 825, Wilmslow Road, Manchester, 20, by 11th July, 1960. 5144

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:—

THIRD AND FOURTH ASSISTANT ENGINEER, SYSTEM DESIGN SECTION, TECHNICAL DEPT., DIVISIONAL HEADQUARTERS. (Vacancy No. 170/ER/60).

THIRD ASSISTANT ENGINEER. Salary AX.6, £1,090-£1,305; AX.7, £1,005-£1,215; AX.8, £925-£1,130 (according to experience and qualifications).

FOURTH ASSISTANT ENGINEER. Salary AX.11, £735-£930. Progression to a higher salary scale will be dependent on qualifications, ability and experience.

The section is concerned with the investigation of schemes for the extension of the main transmission system in South Wales and has to deal with a wide variety of power system problems including load flow studies, fault investigations, and the analysis of system behaviour. The section has at its disposal a D.C. calculating board and an A.C. network analyser.

Candidates should have a University Degree or Higher National Certificate, and some practical experience in the supply or manufacturing industries would be an advantage.

THIRD ASSISTANT ENGINEER, EFFICIENCY, TESTING AND COMBUSTION SECTION, GENERATION DEPARTMENT, DIVISIONAL HEADQUARTERS (Vacancy No. 171/ER/60).

Salary AX.8, £925-£1,130.

The successful candidate will be required to assist in organising and conducting acceptance tests on new generating plant, routine plant tests and investigations into operational difficulties, and improving power plant performance in power stations within the South Wales Division. A knowledge of standardisation and calibration of test instruments and electronics would be an advantage.

Candidates should have considerable experience of modern power plant, operation and efficiency control, and possess qualifications leading to corporate membership of an appropriate professional institution.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, by 22nd July, 1960. 5165

PHILIPS ELECTRICAL INDUSTRIES LIMITED

have a vacancy for an

ELECTRICAL DRAUGHTSMAN

in their

CENTRAL PLANT DEPARTMENT
at CROYDON, SURREY

The work involves the design and layout of power and lighting installations for large factories and office blocks. Candidates should have electrical drawing office experience, and preferably have reached O.N.C. (Elect.) standard.

Commencing salary will be according to age and experience and the Company's conditions of employment include progressive pension, life assurance, holiday and sick pay schemes.

Applications, in writing, should be addressed to:—

The Personnel Officer (11/ER)
PHILIPS ELECTRICAL INDUSTRIES LIMITED
Waddon House, Stafford Road
Croydon, Surrey

5129

Development Engineers

'ENGLISH ELECTRIC'

Stafford

Increasing product development activity gives rise to a number of posts associated with work on the whole range of power plant manufactured at Stafford.

Suitably qualified electrical and mechanical engineers interested in development in one of the following fields are invited to visit the Works to discuss these openings.

- **LARGE ROTATING MACHINES OF ALL KINDS.**
- **HIGH POWER STUDIES RELATED TO CIRCUIT BREAKERS.**
- **POWER TRANSFORMERS OF THE HIGHEST VOLTAGES AND RATINGS.**
- **INSTRUMENTS AND PROTECTIVE RELAYS.**
- **MERCURY ARC AND SEMI CONDUCTOR RECTIFIERS.**
- **INSULATION MATERIALS AND PROCESSES RELEVANT TO THE FOREGOING.**

We are looking for engineers capable of creative work and taking charge of a project on their own.

HOUSING ASSISTANCE will be considered where successful applicants are otherwise unable to settle in the area.

Please write giving full details to

DEPT. G.P.S., MARCONI HOUSE, 336/7 STRAND, LONDON, W.C.2

quoting reference ER 1295L

5028

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER, Twickenham and Richmond District.

Salary £800 to £875 per annum plus London allowance under N.J.B. Class F, Grade 9. Superannuable. Applicants should have had a good general education, be technically trained up to Higher National Certificate standard and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications, quoting ER and naming two referees, on forms from District Manager, SEEBOARD, 42, York Street, Twickenham, Middlesex, by 20th July, 1960.

SENIOR DEMONSTRATOR, Woking District.

Salary within the range £700 × £25 to £775 p.a. under N.J.C. Grade 2. Superannuable. Applicants should hold a recognised qualification in Domestic Science and the E.A.W. Certificate. They should be experienced in giving talks and demonstrations on all types of domestic apparatus and be prepared to work anywhere in Woking District. The successful applicant will be required to assist in general showroom work.

Applications, quoting ER and naming two referees, on forms obtainable from Woking Manager, SEEBOARD, 4, Chobham Road, Woking, by 20th July, 1960.

GEORGE WRAY,
Secretary.
5169

BRITISH STANDARDS INSTITUTION

Technical Staff

THE B.S.I. invites applications from ELECTRICAL ENGINEERS, preferably with some experience in the design and/or testing of domestic electrical appliances, to join the technical staff of the Institution. This staff is responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry, and is required to plan and progress the work. They act as secretaries to technical committees.

Applicants should have a university degree or equivalent professional qualification in electrical engineering.

There are three grades of appointment and salaries in the top grade range up to £2,000 plus; applications are invited for the grade which has at present a maximum salary of £1,250, the starting salary being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishments Officer, B.S.I., 2, Park Street, London, W.1. 5175

PYROTENAX LIMITED

require ELECTRICAL DRAUGHTSMAN for interesting work associated with space heating. Experience of cable layout work desirable.

Apply giving details of experience and qualifications to the Contracts Manager, Pyrotenax Limited, Hedgeley Road, Hebburn, Co. Durham. 5176

W. E. SYKES LIMITED

require:—

ELECTRICAL DRAUGHTSMEN

Preferably with O.N.C. and apprenticeship served, and some experience of electronic work. Required to enlarge staff working on machine tool control gear, electro-mechanical assemblies, electronic test gear. Training available.

ELECTRICAL TECHNICIAN

Similar qualifications, to construct and carry out tests on electronic control, measuring and recording equipment, electrical - mechanical assemblies and test gear.

Generous salaries, excellent prospects and good working conditions. Non-contributory pension scheme.

Apply giving details of education, experience, age and salary to:—

Personnel Officer

Manor Works

Staines, Middx.

5122

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

STATION CHEMIST, BURTON-ON-TRENT POWER STATION (Vacancy No. 165/60).

Applications are invited for the position of Station Chemist at Burton Power Station, Wetmore Road, Burton-on-Trent.

Previous experience in a power station laboratory is essential and candidates should hold the Higher National Certificate in Chemistry.

Applicants must be familiar with the sampling and analysis of coal, water and oil and the interpretation of the analytical results.

Salary will be in accordance with Class E, Grade 7 (£845-£930 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 15th July, 1960.

ASSISTANT SHIFT CHARGE ENGINEER, COVENTRY POWER STATION (Vacancy No. 166/60).

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants are required to take charge of shift operation of boiler house plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of fuels and chain grate stokers.

Salary will be in accordance with Class G, Grade 9 (£845-£930 per annum) of the National Joint Board Agreement, plus shift enhancement.

Closing date for receipt of applications, 15th July, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.
5160

NORTH EASTERN ELECTRICITY BOARD

Wear Sub-Area

APPLICATIONS are invited for the following appointments, all subject to N.J.B. Agreement. Applicants must have had sound practical training and experience in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and equipment. Preference will be given to candidates with qualifications leading to Corporate Membership of I.E.E.

SECOND ASSISTANT DISTRICT ENGINEERS, at Durham and Sunderland. Salaries Schedule A, Class G, Grade 7, £950/£1,055.

SECOND ASSISTANT DISTRICT ENGINEER, Crook District. Salary Schedule A, Class E, Grade 7, £845/£930.

THIRD ASSISTANT DISTRICT ENGINEERS, at Chester-le-Street, Durham and Sunderland. Salaries Schedule A, Class G, Grade 9, £845/£930.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement. 5171

ISLE OF MAN ELECTRICITY BOARD

Engineer and Secretary

APPLICATIONS are invited for the appointment of ENGINEER and SECRETARY to the Board at a salary of £1,950 per annum.

Applicants should be Corporate Members of the Institution of Electrical Engineers with experience in all branches of electricity supply work.

Further information regarding the appointment and a form of application obtainable from the Engineer and Secretary, Isle of Man Electricity Board, Harcroft, Douglas, Isle of Man.
5111

SOUTHERN ELECTRICITY BOARD

Control Engineer

SUB-AREA Engineering Department of No. 1 (Southall) Sub-Area, located at North Hyde Substation, Hayes, Middlesex. Salary N.J.B. Class M, Grade 10 (£1,080-£1,215 per annum, plus 10% shift allowance, plus London allowance). N.J.B. conditions of service.

The duties of the post will be the control of loading and switching operations on an interconnected distribution network operating at voltages up to and including 66 kV.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2/6, Windmill Lane, Southall, Middlesex, and returned to him, quoting Z.1217, not later than 18th July, 1960.
5163

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Kingston Power Station

GENERAL ASSISTANT ENGINEER (Control) (Vacancy No. 149/60). Experience of modern turbo-alternator plant is desirable and the possession of an Ordinary National Certificate in Engineering will be an advantage.

Salary Class G, Grade 13, £770-£855 per annum, inclusive of shift allowance and London allowance.

Applications in writing, giving details of education, age, present position, etc., should be sent to the Station Superintendent, Kingston Power Station, Down Hall Road, Kingston-upon-Thames, Surrey, to arrive by 20 July, 1960. 5164

CHEMICO

require

SENIOR ELECTRICAL DRAFTSMEN

with experience of DISTRIBUTION, POWER, LIGHTING and INSTRUMENTATION for heavy industrial applications.

Minimum qualifications H.N.C. and having five years' experience in this type of work. Must be able to work with minimum supervision.

Employment in one of the most modern office blocks in London's West End where excellent working conditions are available with scope for advancement in this American Company.

Please reply by mail giving full particulars to:—

D. Grive, Chief Draftsman

CHEMICAL CONSTRUCTION (G.B.) LIMITED

9 Henrietta Place, London, W.1

(Subsidiary of Chemical Construction Corporation, New York) 5081

COLLEGE OF ADVANCED TECHNOLOGY, BIRMINGHAM

Department of Electrical Engineering

APPLICATIONS are invited for the post of ASSISTANT GRADE B.

Salary scale: (men) £700-£1,150 with additional training and graduate allowances where applicable. In fixing the commencing salary, account will be taken of teaching and industrial experience.

Further particulars and forms of application from the Bursar, College of Advanced Technology, Gosta Green, Birmingham, 4.

Applications to be received within 14 days of this advertisement. Please quote "G."

K. R. PILLING,
Clerk to the Governors.
5118

DESIGNER

OTTERMILL SWITCHGEAR have a vacancy for a qualified engineer to act as deputy to the Chief Designer. The position is one of responsibility, and requires an experienced man who is prepared to devote his ability to the further advancement of the Company's expansion in the medium voltage switchgear field.

Good salary and prospects with a Company near the South Devon coast. There is a non-contributory pension scheme, and assistance with housing accommodation will be available if required.

Apply, giving full details of qualifications and experience, to the Chief Designer, Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 5058

COVENTRY TECHNICAL COLLEGE

Principal: H. C. Smith, M.Sc., Ph.D., F.R.I.C.

OWING to promotions and to an increase in the College establishment, the following post is vacant, duties to commence 1st September, 1960, or as soon after this date as may be practicable.

The College provides courses for Ordinary National Certificates in a number of subjects: City and Guilds Certificates in Engineering, Building, Catering; General Certificates of Education up to Advanced level; Commercial subjects and Homecrafts.

ELECTRICAL ENGINEERING DEPT.

ASSISTANT GRADE B for ELECTRICAL INSTALLATION classes. City and Guilds Final Certificate with appropriate industrial and teaching experience essential.

Salary scale £700-£1,150 per annum, plus additions for training and qualifications which may amount to £285 for Honours Graduates. Commencing salary depends on age and experience.

Application forms and further particulars from Principal, Coventry Technical College, Butts, Coventry (stamped addressed foolscap envelope required).

W. L. CHINN,
Director of Education.
5166

DRAUGHTSMEN REQUIRED BY LIGHTING EQUIPMENT MANUFACTURER

A GOOD opportunity for young draughtsmen arises in the London office of a well-known and established manufacturer of a variety of specialised lighting fittings. Some works experience or training preferred.

Convenient to Victoria and Waterloo stations. 5-day week, contributory pension scheme.

Write fully to—Box 5004.

***Situations Vacant** (continued)*

YORKSHIRE ELECTRICITY BOARD

No. 5 (Wakefield) Sub-Area

FOURTH ASSISTANT ENGINEER (Distribution Design). Applicants must hold at least the Higher National Certificate in Electrical Engineering, and should have had some experience in the construction, operation and maintenance of distribution networks, and in the planning of H.V. and L.V. overhead and underground distribution systems, and the design of substations. Experience in the preparation of reports, load estimates and capital budgets is desirable.

Salary N.J.B. Class L, Grade 13 (Scale 7), £845/£930 per annum.

CASTLEFORD DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should have had practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Candidates must have attained the technical standard of the Higher National Certificate in Electrical Engineering or equivalent qualifications. Candidates must be prepared to reside in the district and undertake standby duties.

Salary N.J.B. Class G, Grade 9 (Scale 7), £845/£940 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 22nd July, 1960.

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT

THIRD ASSISTANT ENGINEER (Installations). Applicants should have practical experience in the supervision of the day-to-day work of Installation Inspectors and Electricians engaged on the servicing of consumers' apparatus and installations. An appropriate technical qualification will be an advantage.

Salary N.J.B. Class H, Grade 10 (Scale 7), £845/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 22nd July, 1960. 5172

EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified persons for the following appointments:—

Lincolnshire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER, Boston District (Vacancy No. 85/60).

Salary N.J.B. Class F, Grade 9, Scale 6, £800 to £875 per annum.

Candidates should have had practical experience of the operation and maintenance of Urban and Rural distribution systems up to 11 kV. The successful candidate will be required to undertake standby duties and to reside within the district.

Applications giving details of experience, etc., should be addressed to the Manager, Lincolnshire Sub-Area, North House, Grantham, Lincs., within fourteen days of the date of this advertisement.

Northamptonshire Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER, Kettering District (Vacancy No. 86/60).

Salary N.J.B. Class G, Grade 7, Scale 9, £950 to £1,055 per annum.

The duties include responsibility for the construction, operation and maintenance of underground and overhead systems including substations up to 11 kV. Possession of the Higher National Certificate in Electrical Engineering would be an advantage.

Ability to drive a car is essential. The successful applicant will be required to reside within the district and to undertake standby duties.

Applications giving details of experience, etc., should be addressed to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, within fourteen days of the date of this advertisement. 5170

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION

Domestic Appliances Division

APPLICATIONS are invited for the post of TECHNICAL ASSISTANT in the Domestic Appliances Division of the Association. The successful candidate, aged between 25 and 35, should offer :—

(a) An electrical engineering qualification up to H.N.C. standard.

(b) Knowledge of the domestic electrical appliances industry.

(c) Administrative experience, including the writing of reports and committee minutes.

(d) Proved ability to work on his own.

The post is a progressive one with prospects of advancement to a higher grade. Initial salary will fall within the range of £750-£1,100, depending on qualifications and experience. There is a contributory superannuation scheme.

Applications should be addressed to the Secretary, B.E.A.M.A., 36, Kingsway, London, W.C.2. 5173

FULLY QUALIFIED ELECTRICAL ENGINEER

required for the London area by
STURTEVANT ENGINEERING Co. Ltd.
Southern House
Cannon Street, London, E.C.4

Age 25/45. Works apprenticeship and H.N.C. (Electrical) essential. Must have experience in preparation of specifications and wiring diagrams, and be fully conversant with the estimating and application of motors and control gear and associated equipment.

Contributory pension scheme; five-day week; holidays honoured.

Apply in writing, giving particulars of age, education and experience to Staff Engagements Officer at above address.

5177

MINISTRY OF AVIATION

ELECTRICAL ENGINEERS (Assistant Signals Officers) required for aviation telecommunications and electronic navigational aids. Minimum age 23; 1st or 2nd Class Degree in Physics or Engineering, or A.M.I.E.E. or A.F.R.Ae.S. (candidates with Parts I, II and III of A.M.I.E.E. or Parts I and II of A.F.R.Ae.S. or equivalent, or of very high professional attainment without these qualifications considered).

Salary £690 (age 23) to £1,125 (age 34), maximum £1,300. Slightly lower outside London and for women.

Further details and forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.161/OA. 267

POWER CAPACITORS

SALES MANAGER required by progressive firm wishing to expand its business in power capacitors. Applicants should have a wide knowledge of the application of capacitors and should be keen and energetic.

Applications, which will be treated in strict confidence, should be sent to—Box 5123.

HIGH TENSION SWITCHGEAR DESIGNER

WE have a vacancy in our modern drawing office for a young draughtsman who is approaching senior status. The successful applicant will be experienced or interested in the design of HIGH TENSION SWITCHGEAR.

Advantages include: non-contributory pension scheme, good canteen and the usual sports, social and welfare facilities.

Apply, Personnel Manager, George Ellison Limited, Perry Barr, Birmingham, 22b. 5178

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Grade K.9, scale No. 10, £1,010-£1,130 per annum, plus 10% for shift duties.

A sound technical training and practical experience in the operation and maintenance of a modern power station are required. Appropriate technical qualifications desirable. Applicants who previously applied for this position will be reconsidered and need not re-apply.

Apply, quoting Vacancy No. 169/60MD, on form AE6, available from the Station Superintendent, Nechells Power Station, off Aston Church Road, Nechells, Birmingham, 7, to whom they should be returned when completed not later than 22nd July, 1960. 5161

ASSISTANT ELECTRICAL ENGINEERS

SENIOR and INTERMEDIATE GRADES are invited to apply for vacancies in an expanding department of Consulting Engineers' London Office, for work on industrial and commercial projects comprising the design, specification and estimates for power distribution schemes, electrical installations within buildings, heating, lighting and power.

Applicants should have served an apprenticeship or equivalent practical training together with experience in this work and must hold National Certificate or equal qualifications.

Applicants should send in confidence, education, training, age and experience to:—

FREDERICK S. SNOW & PARTNERS
Electrical Section
144, Southwark Street
London, S.E.1 5095

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

SENIOR COMMERCIAL ASSISTANT (Vacancy No. 46/60) required in the Area Commercial Officer's Department at 13, Murray Place, Stirling, to undertake sales and advisory work associated with rural development.

Salary N.J.C. Grade 5, £885 × £25 to £960. The post is superannuable.

Applications, on the standard form obtainable from the undersigned, to be submitted not later than 18th July, 1960.

JAMES G. CURTIS,
Woodlands, Manager.
St. Ninians Road,
Stirling. 5117

TECHNICAL SALES ENGINEER

required by old-established manufacturer of rotary electrical equipment. This is a senior appointment which will admit to the company's pension scheme. Candidates should have considerable knowledge of electric motors and generators and their applications and should preferably hold a H.N.C. or equivalent qualification.

Salaries will be in accordance with experience and qualifications. Any 1960 holiday commitments will be honoured.

Please write giving full particulars to:—

Sales Director
SMALL ELECTRIC MOTORS LTD.
Churchfields Road, Beckenham, Kent
5189

SURREY COUNTY COUNCIL

APPLICATIONS invited for appointment of ELECTRICAL ENGINEER, salary rising to a maximum of £1,220 per annum according to age, qualifications and experience, plus £40/£45 p.a. London allowance. Must be A.M.I.E.E. and have had experience in design of large electrical services installations. The successful applicant must be capable of taking charge of works from commencement to final completion.

Applications stating fully age, qualifications, experience and present salary, accompanied by copies of three testimonials, to County Architect, County Hall, Kingston-on-Thames, as soon as possible. 5054

UNIVERSITY OF BIRMINGHAM

(a) ELECTRICAL ENGINEER. Well-qualified man required for interesting and responsible work on maintenance and extensive development programme.

(b) CHIEF CLERK. Suitably qualified man to take charge of office. Must have good all-round experience in building and allied trades costings.

Commencing salary within the scale £950 × £50 to £1,250 and the appointments will include membership of the F.S.S.U. Previous applications will be considered.

Further particulars and application forms may be obtained from the Superintendent of Buildings and Chief Engineer, The University, Birmingham, 15, to whom applications should be sent not later than 23rd July, 1960. 5174

ELECTRICAL ENGINEERS

STAFF of the following catagories are required by small but rapidly expanding office of London based Danish Consulting Engineering firm:—

ENGINEERS.
Salary range £1,000/£1,500 per annum.
ASSISTANT ENGINEERS.
Salary range £400/£1,000 per annum.

Experience in the design and specification of electrical services in educational and public buildings is essential for the engineer and membership of the appropriate institutions is desirable, but not essential. Apply:—

STEENSEN, VARMING & MULCAHY
146, New Cavendish Street
London, W.1 5057

SWITCHGEAR APPLICATIONS ENGINEER

AN interesting position awaits a young engineer with experience in circuit-breaker protection schemes. A graduate or holder of a Higher National Certificate is preferred but not altogether essential. The successful candidate will deal with application problems at all voltages up to 11 kV.

The many advantages include non-contributory pension scheme.

Apply, Personnel Manager, George Ellison Limited, Perry Barr, Birmingham, 22b. 5179

SENIOR DEVELOPMENT ENGINEER

AN experienced contactor development engineer is required, who is capable of producing sound designs in accordance with modern manufacturing techniques.

The company is well established, in an attractive coastal location and the position is a senior one carrying appropriate salary, etc.—Box 5007.

A SITUATION is available for a designer to produce a completely new range of domestic and industrial fittings for fluorescent light tubes, using new technique and material. Must be practical and experienced. Woking area. Please apply—Box 5180.

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BRANCH manager required by leading electrical contractors for West Midlands branch. Applicant must have current experience of, or be holding, a similar position. Remuneration to match experience. Replies in confidence stating all particulars to—Box 4973.

CABLE estimators required by Hackbridge Cable Co. Ltd., Hackbridge, Surrey. Must be fully conversant with estimating for paper, rubber and thermoplastic cables; pensionable post. Write stating age, experience and salary required. For the attention of the Sales Manager. 5097

CONTROL circuit engineer and estimator for automatic motor control gear; O.N.C. or H.N.C. desirable with previous experience; permanent and pensionable situation. Apply giving details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 129

CONTACTOR application and motor control centre design engineer required for expanding company. Good working conditions in modern factory. Own staff aware of this advertisement. Assistance given with housing. Apply to—Box 5040.

COSTING clerk required. Experienced in pricing materials, etc., for electrical contractor's office. Write full details of age, experience and salary required to—Phœnix Electrical Co. (London) Ltd., 16-18, Marshalsea Road, London, S.E.1. 5138

CROMPTON PARKINSON (CHELMSFORD) Limited invite applications for appointments in the machine department, estimating section, at their Chelmsford works. Applicants should have had a sound technical training and some experience in handling enquiries for A.C. and D.C. rotating plant and control gear up to 1,500 h.p./kW capacity. Congenial working conditions with excellent opportunities for advancement. 5-day week. Superannuation scheme. Apply in confidence stating age, whether married or single, with details of experience and training to Personnel Officer, Crompton Parkinson (Chelmsford) Limited, Chelmsford. 5037

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DESPATCH and pricing clerk, senior grade, required by old-established business in the lighting trade. Knowledge of this trade a considerable advantage. This is a well-paid permanent position with prospects. Reply stating age and experience to—Box 4948.

DRAUGHTSMAN (junior) electro/mechanical; interesting situation with excellent prospects. Apply giving full details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 130

ELECTRICAL engineer required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to—British Engine Boiler & Electrical Insurance Co. Ltd., 98, West George Street, Glasgow, C.2. 5150

ELECTRICAL engineer required with experience in planning and estimating all types of installations. Write full details of age and salary required to—Phœnix Electrical Co. (London) Ltd., 16-18, Marshalsea Road, London, S.E.1. 5139

ELECTRICAL engineer with wide experience of estimating and supervision of big industrial and commercial installations required by large electrical contracting company in Manchester. Apply giving full details of training, qualifications, experience and salary expected to—Box 5124.

ELECTRICAL engineering assistants required with experience of any of following:—(a) preparation of specifications for electrical installations in buildings; (b) planning, design, or technical aspects of installation or maintenance of electric lifts; (c) negotiations in connection with electricity supplies, choice of tariff and apportionment of costs. Prospects of advancement in entry grade up to £1,250 for those obtaining H.N.C. (Electrical). Staff restaurant. Pension scheme. Form from—Chief Engineer (GS/ER/1676/7), L.C.C., County Hall, London, S.E.1. 5151

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ELECTRICIANS and mates required. Write or phone—Harris & Sheldon Ltd., Thane Villas, Seven Sisters Road, London, N.7 (North 2475). 5043

ENERGETIC and competent works manager required for rapidly expanding electrical engineering company in Altrincham.—Box 5113.

ENGINEERING consultants require electrical contract design engineers for head office appointment. Applicants age 25-38 should be Graduate or Associate Members I.E.E., with particular knowledge of large industrial installations and extensive wiring and lighting contract work. Also experience in preparation of specifications and design of internal lighting, wiring and cabling installations in large buildings. Salary offered up to £1,200 p.a. depending on qualifications and experience. Applications in writing to—Personnel Officer, Ewbank & Partners Ltd., 10-11, Grosvenor Place, London, S.W.1. 5119

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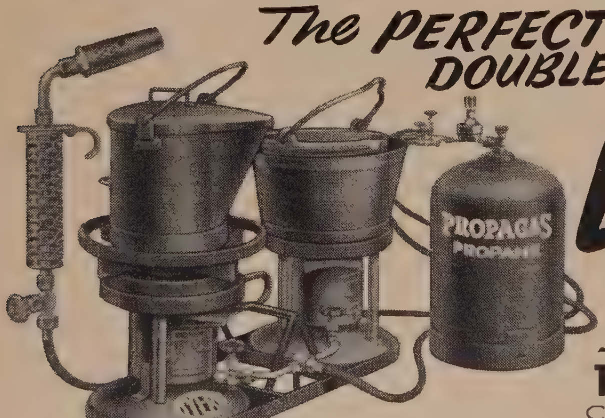

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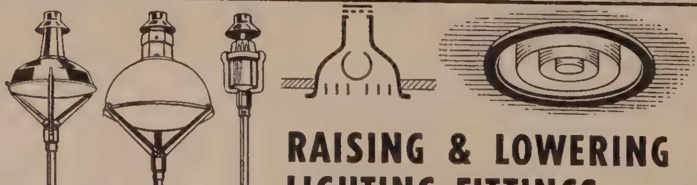

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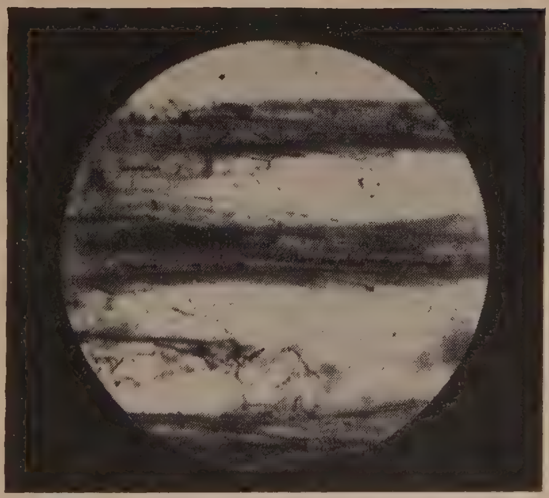

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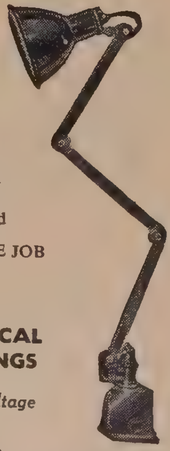

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ELECTRIC FIRES

In response to numerous requests from regular readers of our domestic electrical equipment surveys, commencing with this issue the feature is being presented as a self-contained supplement, easily detachable for binding or for reference purposes. This, the first of the new series, contains the details and prices of approximately 400 different types of electric fires. In the next supplement, to be published on 12th August, we propose to deal with low temperature heaters, i.e. convectors, fan heaters, radiators, etc.

Future supplements covering the many other items of domestic electrical equipment—electric blankets, cookers, home laundry appliances, cleaners and polishers, water heaters, refrigerators, etc., will be published at regular five-weekly intervals.

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
A.E.I. HOTPOINT, LTD., 33, Grosvenor Place, London, S.W.1.	" Hystan " 5551/2	Portable reflector	2 kW	Two 1 kW rod	Yellow and black, red and yellow	£5 0 7	£0 18 11
	" Jewel " 5510/2	Portable reflector	1 kW	One 1 kW rod	Cream, red or blue	£2 2 1	£0 7 11
	" Superglo " 6610 and 6620	Portable reflector	1 or 2 kW	One or two 1 kW rod	Choice of six colours	£2 13 0 (1 kW) £3 10 8 (2 kW)	£0 10 0 (1 kW) £0 13 4 (2 kW)
ARTIC FUSE & ELECTRICAL MFG. CO., LTD., Birtley, Co. Durham.	" Sunnyglow "	Portable, floodlit reflector	1¼ or 1½ kW	One 1¼ or 1½ kW rod	Gold, silver, ivory, blue or green to order	£4 19 0	£0 18 7
	" Sunglade "	Portable, floodlit reflector	2½ or 3 kW	Two 1¼ or 1½ kW rod	Gold, silver, ivory, blue or green to order	£9 13 0	£1 16 2
BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield, Middlesex.	" Hotspur " 141 and 142	Portable reflector	1 or 2 kW	One or two 1 kW rod	Choice of three colours	£2 17 6 (141) £3 12 6 (142)	£0 10 7 (141) £0 13 4 (142)
	" Dinkie " 601 and 602	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze	£1 17 6 (601) £3 0 0 (602)	£0 6 11 (601) £0 11 0 (602)
	" Empire " 402E and 403E	Portable firebar	2 or 3 kW	Two or three 1 kW bar	Beige	£4 0 0 (402E) £5 0 0 (403E)	£0 14 8 (402E) £0 18 4 (403E)
	" Solray " 151 and 152	Portable or wall mounting	1 or 2 kW	One or two 1 kW rod	Black and cream	£3 17 6 (151) £5 5 0 (152)	£0 14 3 (151) £0 19 3 (152)
	" Countess " 233 and 234	Portable reflector	2 or 3 kW	Two or three 1 kW rod	Choice of six colours	£5 17 6 (233) £6 15 0 (234)	£1 1 7 (233) £1 4 9 (234)
	" Modern " 228	Portable reflector	2 kW	Two 1 kW rod	Choice of three colours	£7 2 6	£1 6 2
	" Homeguard " 155	Portable safety reflector	2 kW	Two 1 kW rod	Choice of two colours	£11 2 6	£2 0 10
	" Celtic " 753B	Period, log	3 kW	Three 1 kW bar (concealed)	Antique (rustless)	£29 15 0	£5 9 1
	" Adam " 743B	Period, coal	3 kW	Three 1 kW bar (concealed)	Armour bright (rustless)	£27 2 6	£4 19 6
	" Adam " 915 and 916	Period, firebar	2 or 3 kW	Two or three 1 kW bar	Armour bright (rustless)	£12 7 6 (915) £14 10 0 (916)	£2 5 5 (915) £2 13 2 (916)
	" Princess " 212 and 213	Imitation coal	2 or 3 kW	Two or three 1 kW rod	Choice of two colours	£10 10 0 (212) £11 10 0 (213)	£1 18 6 (212) £2 2 2 (213)
	" Princess " 212A and 213A	Imitation log	2 or 3 kW	Two or three 1 kW rod	Choice of two colours	£11 0 0 (212A) £12 0 0 (213A)	£2 0 4 (212A) £2 4 0 (213A)
	" Medieval " 640 and 640A	Imitation coal (640) or log (640A)	3 kW	Three 1 kW bar	Antique (rustless)	£15 10 0 (640) £17 7 6 (640A)	£2 16 10 (640) £3 3 9 (640A)

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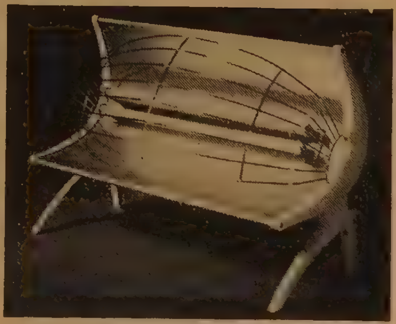

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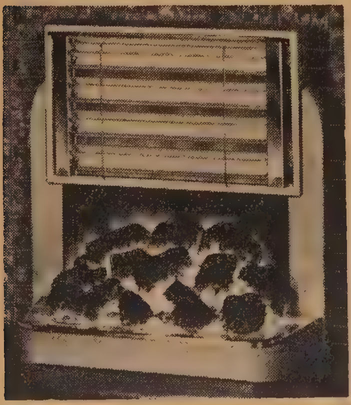
BELLING & CO., LTD., **Bridge Works,** **Southbury Road,** **Enfield,** **Middlesex.** *(continued)*	"Medieval" 639 and 639A	Imitation coal (639) or log (639A)	2 kW	Two 1 kW bar	Antique (rustless)	£13 12 6 (639) £15 7 6 (639A)	£2 10 0 (639) £2 16 5 (639A)
	"Waverley" 264 and 264P	Imitation coal, reflector	3 kW	Three 1 kW rod	Choice of three colours	£18 17 6 (264) £22 16 0 (264P)	£3 9 3 (264) £4 3 8 (264P)
	"Melrose" 274	Illuminated, reflector	3 kW	Three 1 kW bar or rod	Choice of two colours	£16 17 6	£3 1 11
	"Converta" 178 and 179	Fireplace screen, firebar (178) or reflector (179)	2 kW	Two 1 kW bar or rod	Ripple bronze	£7 17 6 (178) £8 7 6 (179)	£1 8 11 (178) £1 10 9 (179)
	"Hearth" 159 and 159A	Imitation coal (159) or log (159A)	2 kW	Two 1 kW bar	Bright (rustless) or bronze	£8 10 0 (159) £10 7 6 (159A)	£1 11 2 (159) £1 18 1 (159A)
	C/1/131 and C/2/132	Panel, bronze inset	1 or 2 kW	One or two 1 kW bar	Choice of six colours (panels)	£3 8 0 (C/1/131) £4 15 0 (C/2/132)	£0 12 6 (C/1/131) £0 17 5 (C/2/132)
	C/2A/132	Panel, chromium inset	2 kW	One or two 1 kW bar	Choice of six colours (panels)	£5 13 0	£1 0 9
BERRY'S ELECTRIC MAGICOAL, LTD., **Touchbutton House,** **Newman Street,** **London, W.1.**	"Adjustaberry" 457	Imitation fuel	2½ kW	Two 1¼ kW bar	Armour bright	£12 10 8	£2 5 10
	"Alderberry" 110	Imitation fuel	2 kW	Two 1 kW. rod	Armour bright	£20 13 5	£3 15 7
	"Berrylog" A.21/O	Imitation fuel	1½ kW	Two ¾ kW bar	Satin antique	£10 12 8	£1 18 10
	"Berrylog" A.21/S	Imitation fuel	1½ kW	Two ¾ kW bar	Satin antique	£9 18 8	£1 16 4
	"Emberberry" 108	Imitation fuel	2 kW	Two 1 kW bar	Armour bright	£16 10 7	£3 0 5
	"Emberberry" 109 (with dogs)	Imitation fuel	2 kW	Two 1 kW bar	Armour bright	£19 14 10	£3 12 2
	"Masterberry" 444	Imitation fuel	2 kW	Four ½ kW rod	Warm silver	£15 17 11	£2 18 1
	"Mayberry" 441	Imitation fuel	2 kW	Two 1 kW rod	Warm silver	£13 3 9	£2 8 3

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
BERRY'S ELECTRIC MAGICOAL, LTD., Touchbutton House, Newman Street, London, W.1. *(continued)*	" Woodberry " 406	Imitation fuel	3 kW	Two 1½ kW bar	Armour bright	£16 13 11	£3 1 1
	" Adam Shell " 8	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£44 18 4	£8 15 2
	" Fleur-de-Lis " 40	Imitation fuel	3 kW	Two 1½ kW rod	Armour bright	£37 8 1	£7 5 11
	" Georgian " 2	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£39 7 10	£7 13 8
	" Jacobean " 5	Imitation fuel	3 kW	Two 1½ kW rod	Armour bright	£30 18 5	£6 0 7
	" Queen Anne " Pedestal 11	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£49 8 3	£9 12 9
	" Regency " 20	Imitation fuel	2 kW	Two 1 kW rod	Antique bright (rustless)	£38 2 4	£7 8 8
	" Wilton " 42	Imitation fuel	3 kW	Two 1½ kW rod	Antique bright (rustless)	£71 0 1	£13 16 11
	" Berrylog " A.28 (Special 36in)	Imitation fuel	—	Log effect only	—	£12 15 8	£2 9 10
	" Berrylog " A.28 (Standard 24in)	Imitation fuel	—	Log effect only	—	£8 19 11	£1 15 1
	Curb Heater 457	Radiator	2½ kW	Two 1¼ kW bar	—	£7 13 2	£1 9 10
	Curb Heater 98D	Radiator	2½ kW	Two 1¼ kW bar	—	£8 19 11	£1 15 1
	Curb Heater 98E/2	Radiator	2 kW	Two 1 kW bar	—	£9 15 5	£1 18 1
	Curb Heater 98E/2¾	Radiator	2¾ kW	Two 1⅜ kW bar	—	£11 15 2	£2 5 10
	" Charmberry " 454	Imitation fuel	2 kW	Two 1 kW rod	Silver rose or warm silver	£10 19 5	£2 0 1
	" Charmberry " 550	Imitation fuel	3 kW	Three 1 kW rod	Silver rose or warm silver	£12 9 10	£2 5 8
	" Wellberry " 473	Imitation fuel	2 kW	Two 1 kW bar	Hammered finish	£9 19 11	£1 16 7
	" Auraberry " 447	Imitation fuel	2 kW	" Paravec " special	Silver rose or warm silver	£14 17 2	£2 14 4
	" Studio " 633	Portable radiator	2 kW	Two 1 kW rod	Silver rose with cherry legs and handle	£5 1 0	£0 18 6
	" Chameleon " 490 and 491	Colour changing electric fireplace	2 kW	" Paravec " special	—	£27 15 3	£5 8 3
	" Silhouette " 352	Portable radiator	2 kW	" Paravec " special	Silver rose with gunmetal base	£10 10 6	£1 18 6



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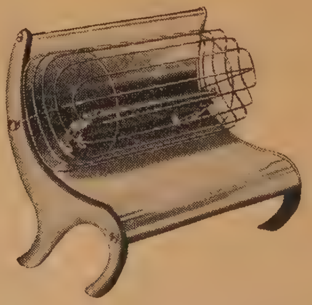

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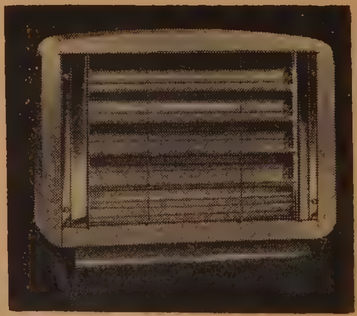

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5. *Berry's " Auraberry " coal effect fire*
6. *Carron " Curtsey " reflector fire*
7. *Berry's " Silhouette " radiant fire*

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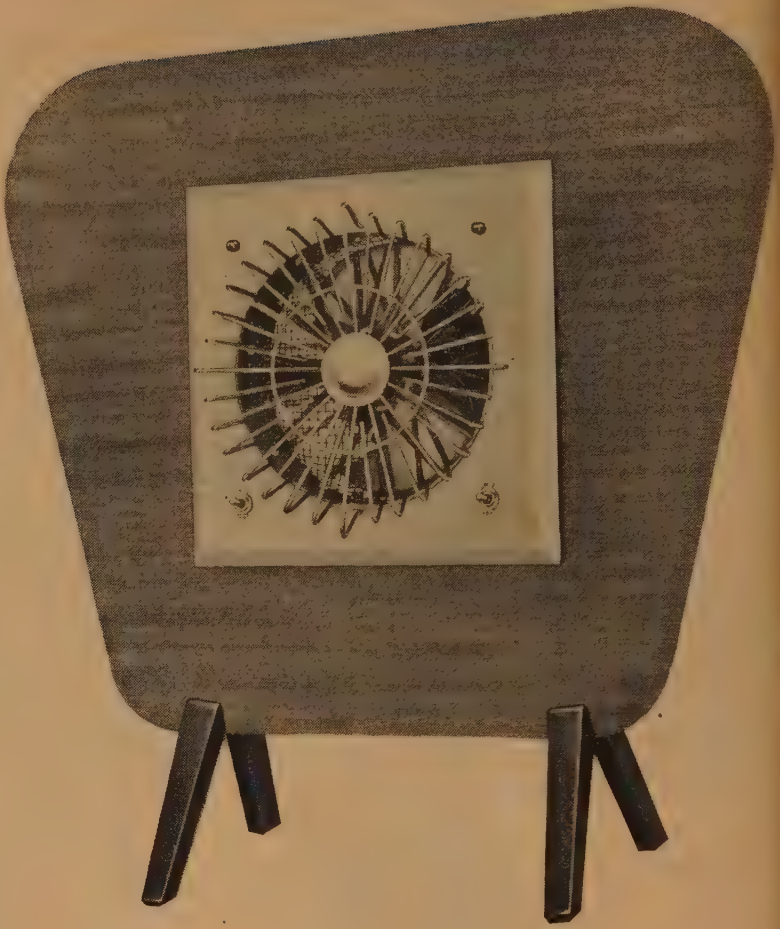

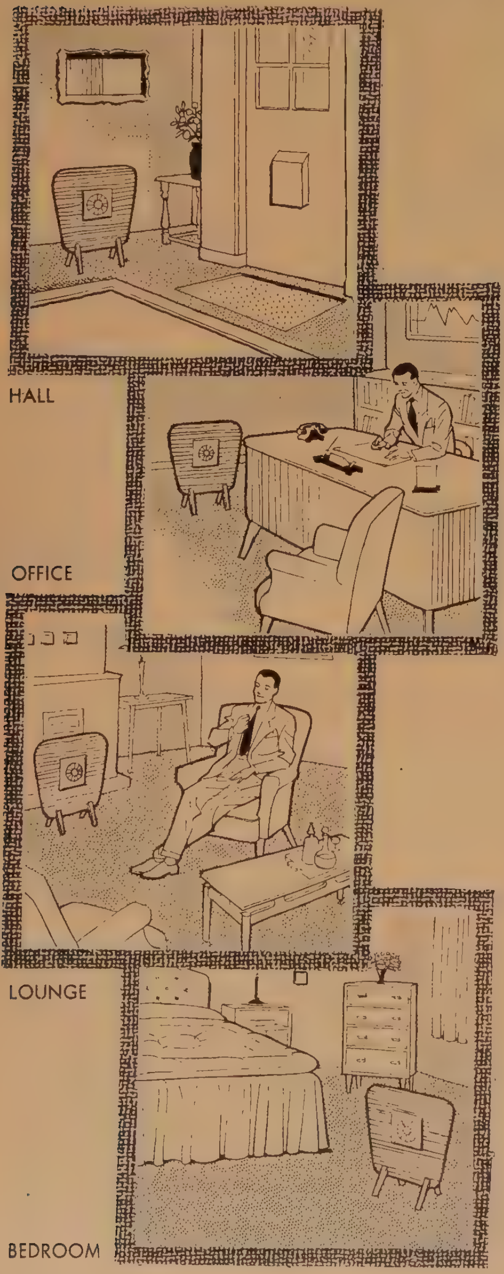

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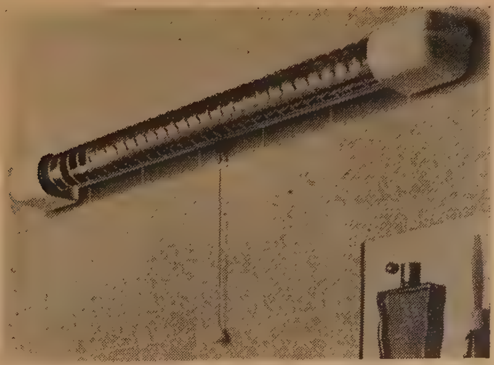
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
BERRY'S ELECTRIC MAGICOAL, LTD., Touchbutton House, Newman Street, London, W.I. (*continued*)	" Mistoberry " 382 and 384	Fixed colour electric fireplace	2 kW	" Paravec " special	—	£20 19 8	£4 1 10
	Panel 597	Wall mounting radiator	2 kW	" Paravec " special	Silver rose	£9 19 6	£1 16 6
CARRON COMPANY, Carron, Falkirk.	" Sirius "	Portable firebar	1 or 2 kW	One or two 1 kW bar	Vitreous enamel	£2 2 6 (1 kW) £3 7 6 (2 kW)	£0 7 9 (1 kW) £0 12 4 (2 kW)
	" Curtsey "	Portable reflector	1 or 2 kW	One or two 1 kW rod	" Carrontine "	£2 2 6 (1 kW) £3 1 6 (2 kW)	£0 7 9 (1 kW) £0 11 3 (2 kW)
	" Sunglo "	Portable reflector	2½ kW	Two 1¼ kW rod	Chromium	£8 12 0	£1 11 5
	" Precentor "	Portable reflector	1 or 2 kW	Two 1 kW rod	" Carrontine," cream and gold	£3 16 0 (1 kW) £4 17 0 (2 kW)	£0 13 11 (1 kW) £0 17 9 (2 kW)
	" Firebird "	Portable firebar	1 kW	One 1 kW spiral	" Carrontine," various finishes	£2 15 0	£0 10 1
E. K. COLE, LTD., 5, Vigo Street, London, W.I.	" Victor 10 " PF1	Portable reflector	1 kW	One 1 kW rod	Cream enamel, chromium or copper reflector	£2 17 6	£0 10 5
	" Victor 20 " PF2	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream enamel, chromium or copper reflector	£3 13 0	£0 13 3
	" Victor 25 " PF25	Portable reflector	1¼ or 2½ kW	One or two 1¼ kW rod	Cream enamel, chromium reflector	£5 5 0	£0 19 0
	" Minora 20 " WF2	Low level wall mounting reflector	1 or 2 kW	One or two 1 kW rod	Bronze enamel, chromium or copper reflector	£3 15 0	£0 13 7
	" Flamera " DF2	Reflector, imitation coal	1 or 2 kW	One or two 1 kW rod	Bronze enamel with copper reflector or silver enamel with chromium reflector	£12 10 0	£2 5 2
	" Firestreak " FS75 and FS75/S	Wall mounting	750 W	Infra-red spiral in silica tube	Chromium reflector, coloured end caps	£3 10 0 (FS75) £4 0 0 (FS75/S–with switch)	£0 12 8 (FS75) £0 14 6 (FS75/S–with switch)
CRANMER & CHESHIRE, LTD., Steward Street, Spring Hill, Birmingham, 18.	" Nichro " 450	Portable tilting reflector	1 or 2 kW	One or two 1 kW rod	Silver grey or cream	£3 8 4 (1 kW) £4 4 6 (2 kW)	£0 12 6 (1 kW) £0 15 5 (2 kW)
	" Nichro " 424	Portable double tilting reflector	2 kW	Two 1 kW rod	Silver grey	£5 15 6	£1 1 1
	" Nichro " 453	Portable tilting reflector	¾ or 1½ kW	One or two ¾ kW rod	Silver grey or cream	£3 2 6 (¾ kW) £3 15 6 (1½ kW)	£0 11 6 (¾ kW) £0 13 10 (1½ kW)
	" Nichro " 438	Portable tilting reflector with glow lamp behind grille	2 kW	Two 1 kW rod	Silver grey	£6 0 9	£1 2 1

8. *"Firestreak" infra-red heater (E. K. Cole)*

9. *"Flamera" imitation coal effect fire (E. K. Cole)*



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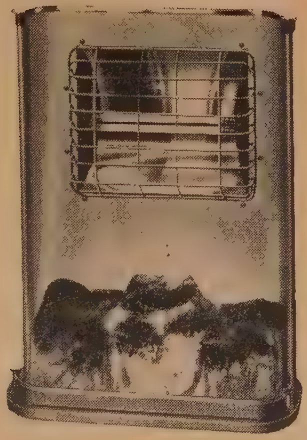

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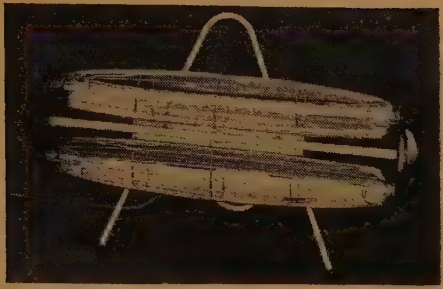
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
CRANMER & CHESHIRE, LTD., **Steward Street,** **Spring Hill,** **Birmingham, 18.** *(continued)*	" Nichro " 451	Wall fixing	1 kW	One 1 kW rod	Cream enamelled or silver grey	£3 9 10	£0 12 10
	" Nichro " 452	Wall fixing	¾ kW	One ¾ kW rod	Cream enamelled or silver grey	£3 6 2	£0 12 2
	" Nichro " 448	Wall fixing	¾ or 1 kW	One ¾ or 1 kW rod	Cream and gold	£2 19 0 £3 7 0 (with switch)	£0 10 10 £0 12 3 (with switch)
	" Nichro " 454	Portable, non-tilting reflector	1 or 2 kW	One or two 1 kW rod	Silver grey or cream	£2 13 0 (1 kW) £3 9 0 (2 kW)	£0 9 8 (1 kW) £0 12 8 (2 kW)
R. & A. G. CROSSLAND, LTD., **55, Ebury Street,** **London, S.W.1.**	" Raydant " 800/1	Portable reflector	1 kW	One 1 kW rod	Cream	£2 6 0	£0 8 4
	" Raydant " 800/2	Portable reflector	2 kW	Two 1 kW rod	Cream	£2 19 0	£0 10 8
DIMPLEX, LTD., **Millbrook,** **Southampton.**	IRD.750/S	Wall mounting	750 W	One 750 W infra-red spiral	Stove enamelled, various colours	£4 15 0	£0 17 6
	IRF.750	Portable	750 W	One 750 W infra-red spiral	Chromium reflector with cream stand or copper reflector with cream, bronze or black stand	£5 17 6	£1 1 6
	IRF.1500	Portable	1,500 W	Two 750 W infra-red spirals		£9 10 0	£1 14 9
ELECTROWAY HEATERS, LTD., **Rosebery Street,** **Loughborough,** **Leics.**	IR12 and VH2	Inset, vertical reflector	1 and 2 kW	One or two 1 kW rod	Chromium	£2 16 6 (IR12) £4 3 0 (VH2)	£0 10 4 (IR12) £0 15 3 (VH2)
	2A2	Inset, parabolic reflector	2 kW	Two 1 kW rod	Chromium	£7 15 0	£1 8 5
	IH1R, IH2R and IH3R	Inset, horizontal reflector	1, 2 and 3 kW	One, two or three 1 kW rod	Chromium	£3 8 6 (IH1R) £4 14 6 (IH2R) £7 13 6 (IH3R)	£0 12 7 (IH1R) £0 17 4 (IH2R) £1 8 2 (IH3R)
	IH1, IH2 and IH3	Inset, panel bar	1, 2 and 3 kW	One, two or three 1 kW bar	Chromium	£3 1 0 (IH1) £4 2 0 (IH2) £6 11 6 (IH3)	£0 11 2 (IH1) £0 15 0 (IH2) £1 4 0 (IH3)
	IE1R, IE2R and IE3R	Inset, horizontal reflector	1, 2 and 3 kW	One, two or three 1 kW rod	Stoved enamel	£2 9 0 (IE1R) £3 11 6 (IE2R) £5 18 0 (IE3R)	£0 9 0 (IE1R) £0 13 1 (IE2R) £1 1 8 (IE3R)
	IG1R and IG2R	Wall, horizontal reflector	1 and 2 kW	One or two 1 kW rod	Stoved enamel	£3 1 0 (IG1R) £4 6 0 (IG2R)	£0 11 2 (IG1R) £0 15 9 (IG2R)
	IG1 and IG2	Wall, panel bar	1 and 2 kW	One or two 1 kW bar	Stoved enamel	£2 16 0 (IG1) £3 11 0 (IG2)	£0 10 3 (IG1) £0 13 0 (IG2)
	WIR12 and WVH2	Wall, vertical reflector	1 and 2 kW	One or two 1 kW rod	Chromium, stoved enamel plaque	£4 7 0 (WIR12) £5 13 6 (WVH2)	£0 16 0 (WIR12) £1 0 10 (WVH2)
	WH2	Wall, panel bar	2 kW	Two 1 kW bar	Chromium, stoved enamel plaque	£5 12 6	£1 0 8
	WH2R	Wall, horizontal reflector	2 kW	Two 1 kW rod	Chromium, stoved enamel plaque	£6 6 0	£1 3 1
	WE2	Wall, panel bar	2 kW	Two 1 kW bar	Stoved enamel fire and plaque	£4 14 6	£0 17 4
	WE2R	Wall, horizontal reflector	2 kW	Two 1 kW rod	Stoved enamel fire and plaque	£5 3 0	£0 19 0
ENGLEHARD HANOVIA, LTD., **Bath Road,** **Slough,** **Bucks.**	" Radisil " 58	Wall mounting	600 or 800 W	One 600 or 800 W infra-red spiral	Cream stove enamelled. Chromium reflector (*a*) Gold-plated reflector (*b*)	£4 15 0(*a*) £5 10 0(*b*)	£0 17 0(*a*) £1 0 8(*b*)
	" Radisil " 32	Wall mounting	1,600 W	One 1,600 W infra-red spiral		£8 10 0(*a*) £9 10 0(*b*)	£1 11 11(*a*) £1 15 8(*b*)
	" Radisil " 33	Portable	600 or 800 W	One 600 or 800 W infra-red spiral	Cream stove enamelled. Gold-plated reflector	£6 0 0	£1 2 6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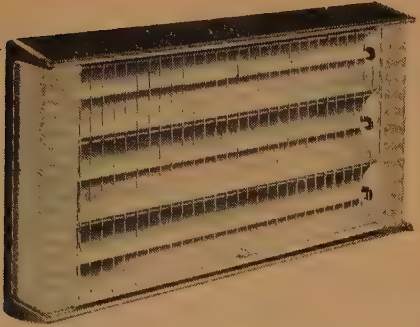
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10. *Dimplex model IRF.1500 portable infra-red fire*
11. *Falk, Stadelmann model U.95764 wall mounting "Supersil" infra-red panel heater*
12. *"Nichro" model 448 infra-red wall fire (Cranmer & Cheshire)*
13. *Engelhard Hanovia model 66 "Radisil" floor standing infra-red fire*

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Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
ENGLEHARD HANOVIA, LTD., **Bath Road,** **Slough,** **Bucks.** *(continued)*	"Radsil" 66	Portable	1,200 or 1,600 W	Two 600 or 800 W infra-red spirals	Cream stove enamelled. Gold-plated reflectors	£9 10 0	£1 15 8
FALK, STADELMANN & CO., LTD., **91, Farringdon Road,** **London, E.C.1.**	"Felicity"	Portable reflector illuminated screen	2 kW	Two 1 kW rod	Polychromatic gold	£6 19 5	£1 5 6
	"Festivity" U.95735	Reflector, illuminated	2 kW	Two 1 kW rod	Gold	£9 0 0	£1 12 11
	"Festivity" U.95736	Wall mounting panel fire	2 kW	Two 1 kW rod	Gold	£7 10 0	£1 7 5
	"Eclipse"	Portable reflector	1 or 2 kW	One or two 1 kW rod	Blue, red or cream	£1 14 9 (1 kW) £2 12 6 (2 kW)	£0 6 4 (1 kW) £0 9 7 (2 kW)
	"Comet"	Portable reflector	1 or 2 kW	One or two 1 kW rod	Off-white and black, cardinal red and black	£1 18 7 (750 W) £1 19 11 (1 kW) £2 19 0 (2 kW)	£0 7 1 (750 W) £0 7 4 (1 kW) £0 10 10 (2 kW)
	"Meteor"	Portable reflector	1 or 2 kW	One or two 1 kW rod	Hollyhock and lilac, cardinal red/cream, mocha/cream, gun-metal/cloud grey	£3 4 6 (1 kW) £3 18 9 (2 kW)	£0 11 10 (1 kW) £0 14 5 (2 kW)
	U.95756 "Supersil"	Wall mounting infra-red reflector	750 W	One 750 W silica tube encased spiral	Cream or cardinal red, complete with double pole on/off cord switch	£4 10 0	£0 16 6
	U.95766 "Supersil"	Wall mounting infra-red reflector	1,500 W	One 1,500 W silica tube encased spiral	Cream or cardinal red, complete with double pole on/off cord switch	£8 10 0	£1 11 1
	U.95765 "Supersil"	Portable infra-red reflector	2¼ kW	Three 750 W silica tube encased spiral	Red/gold, black-gold, independently switched elements	£11 16 8	£2 3 3
	U.95764 "Supersil"	Wall mounting infra-red reflector	2¼ kW	Three 750 W silica tube encased spiral	Red/ivory, grey/ivory, independently switched elements	£11 16 8	£2 3 3
FALKIRK IRON CO., LTD., **28, Brook Street,** **London, W.1.**	39	Portable reflector	1 kW	One 1 kW rod	Stove enamelled, various colours.	£2 4 6	£0 8 2
	41	Portable reflector	2 kW	Two 1 kW rod	Stove enamelled, various colours	£3 2 6	£0 11 5

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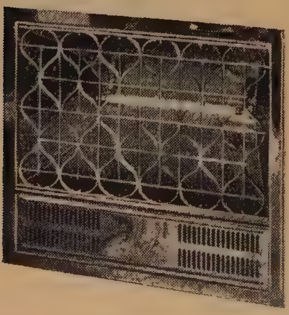
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
FALKIRK IRON CO., LTD., **28, Brook Street,** **London, W.1.** *(continued)*	" Firefly " 43	Portable reflector	1 kW	One 1 kW rod	Stove enamelled, various colours	£2 4 6	£0 8 2
	" Belford "	Inset, wall mounting	1 or 2 kW	One or two 1 kW rod	Copper " Alisheen " front and sides, chromium reflector	£4 15 0 (1 kW) £5 5 0 (2 kW)	£0 17 4 (1 kW) £0 19 2 (2 kW)
	" Belford "	Semi-inset, wall mounting	1 or 2 kW	One or two 1 kW rod	Copper "Alisheen " front and sides, chromium reflector	£5 9 0 (1 kW) £5 19 0 (2 kW)	£1 0 0 (1 kW) £1 1 9 (2 kW)
FERRANTI, LTD., **Hollinwood,** **Lancs.**	P.3310	Panel reflector, ventilating grille	2½ kW	Two 1¼ kW rod	Chromium reflector, frame. Decorative screen £7 7*s* extra	£32 5 0	£5 17 11
	P.33132	Panel reflector	2 kW	Two 1 kW rod	Chromium reflector, frame and guard. Decorative screen £6 6*s* extra	£21 5 0	£3 17 9
	P.33122	Panel reflector	1½ kW	Two ¾ kW rod	Chromium reflector, frame and guard. Decorative screen £5 5*s* extra	£16 7 6	£2 19 10
FORMO PRODUCTS, LTD., **153, Mason's Hill,** **Bromley, Kent.**	" Savoy "	Portable reflector	750 W	One 750 W rod	Stoved enamel	£1 14 0	£0 5 6
	" Connaught "	Portable reflector	1,500 W	Two 750 W rod	Stoved enamel	£2 14 9	£0 8 9
H. FROST & CO., LTD., **Walsall.**	261/2	Portable reflector	1 or 2 kW	One or two 1 kW rod	Stoved enamel	£2 8 4 (1 kW) £3 4 2 (2 kW)	£0 8 9 (1 kW) £0 11 7 (2 kW)
	302	Imitation coal effect	2 kW	Two 1 kW rod	Stoved enamel	£10 7 6	£1 17 6
	401/2	Wall panel	1 or 2 kW	One or two 1 kW rod	Stoved enamel	£2 12 0 (1 kW) £3 15 0 (2 kW)	£0 9 5 (1 kW) £0 13 6 (2 kW)
	167 and 1675	Wall mounting	750 W	One 750 W infra-red spiral	Stoved enamel	£4 3 0 (167) £4 9 7 (1675–with switch)	£0 15 0 (167) £0 16 2 (1675–with (switch)
	168 and 1685	Wall mounting	1,500 W	One 1,500 W infra-red spiral	Stoved enamel	£7 11 0 (168) £7 17 6 (1685–with switch)	£1 7 3 (168) £1 8 6 (1685–with switch)
GATEHILL MFG. CO., LTD., **Kennard Road,** **Stratford, E.15.**	" Sussex "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Silver hammered or red	£1 3 0 (1 kW) £1 18 0 (2 kW)	£0 4 2 (1 kW) £0 6 10 (2 kW)
	" Richmond "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Silver or gold	£1 9 5 (1 kW) £2 4 11 (2 kW)	£0 5 4 (1 kW) £0 8 1 (2 kW)



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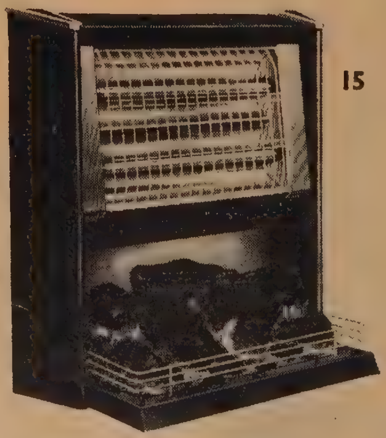

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14. *Ferranti model P.3310 panel fire*

15. *Gatehill Beco " Coalglo " imitation coal effect fire*

16. *Gatehill Beco " Becosil 808 " free-standing infra-red heater*

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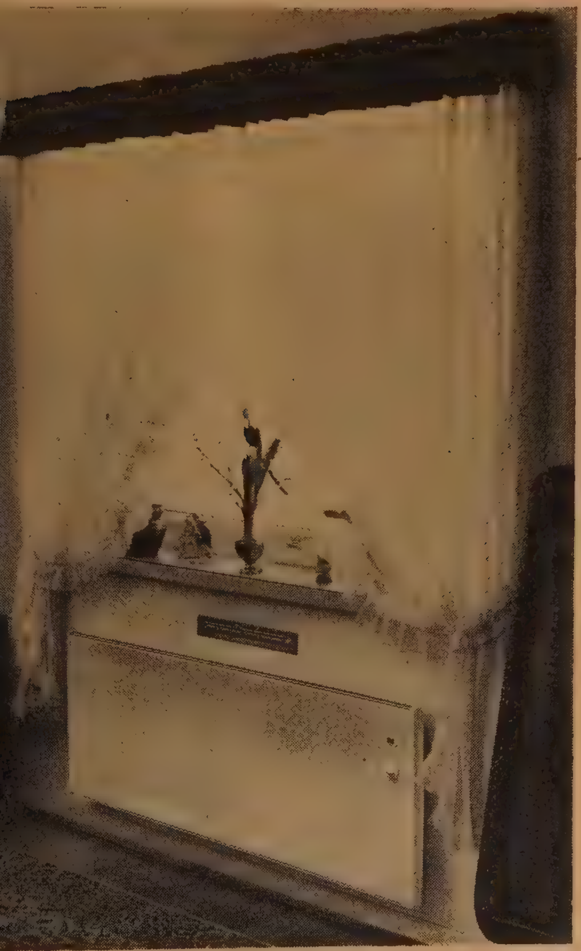

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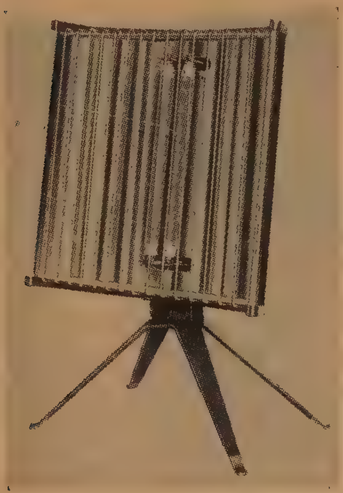

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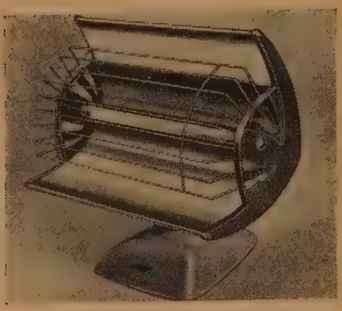

17. G.E.C. model D.2818 " Cosyglo " fire
18. G.E.C. model D.2758 pedestal bowl fire
19. L. G. Hawkins " Loughton " pedestal reflector fire

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
GATEHILL MFG. CO., LTD., Kennard Road, Stratford, E.15. *(continued)*	" Becosil " 707 and 708	Wall mounting	800 W (707) 1,500 W (708)	One 800 W or 1,500 W infra-red spiral	White or red, gold plated guard	£4 10 0 (707) £8 10 0 (708)	£0 16 6 (707) £1 11 1 (708)
	" Becosil " 808	Portable	800 W	One 800 W infra-red spiral	White, red or blue. Chromium guard	£5 17 6	£1 1 6
	" Coalglo "	Imitation coal effect	2 or 3 kW	Two or three 1 kW rod	Red, black or grey. Gold plated guard	£10 10 0 (2 kW) £11 10 0 (3 kW)	£1 18 6 (2 kW) £2 2 2 (3 kW)
G.B.M. (ELECTRICAL) BIRMINGHAM, 439-443, Moseley Road, Birmingham, 12.	" Sunglow "	Wall or ceiling mounting	750 W (*a*), 1,000 W (*b*) or 1,500 W (*c*)	One infra-red spiral	Yellow, red, cream, gold or silver	£3 10 0 (*a*) £4 15 0 (*b*) £6 10 0 (*c*)	£0 11 4 (*a*) £0 15 5 (*b*) £1 1 1 (*c*)
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	D.2496G and D.2497G	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze, cream or green	£1 19 9 (D.2496G) £2 18 9 (D.2497G)	£0 7 3 (D.2496G) £0 10 9 (D.2497G)
	D.2758	Pedestal bowl	750 W	One 750 W spiral	Burgundy legs	£1 17 0	£0 6 9
	D.2775	Portable reflector	2 kW	Two 1 kW rod	Moonstone grey and burgundy with black legs	£5 1 3	£0 18 6
	" Cosyglo " D.2818	Portable reflector	2 kW	Two 1 kW rod	Burgundy and gold	£5 1 3	£0 18 6
	D.2776 and D.2777	Portable reflector	1 or 2 kW	One or two 1 kW rod	Burgundy with black legs	£3 3 10 (D.2776) £4 4 1 (D.2777)	£0 11 8 (D.2776) £0 15 5 (D.2777)
	" Cosyglo " D.2810	Screen illuminated	2½ kW	Two 1 kW rod plus convector	Bronze and red	£13 6 4 (Available	£2 8 8 September)
	D.2819	Portable reflector	2 kW	Two 1 kW rod	Black and red	£5 3 7 (Available	£0 18 11 September)
GRUBB ENGINEERING CO., LTD., Mary Street, Birmingham, 12.	" Grubb "	Portable reflector	2 kW	Two 1 kW rod	Gilt or silver and cream	£3 7 6	£0 12 4
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2.	" Boomerang " LGH.339 and LGH.340	Portable reflector	1 kW (339) 2 kW (340)	One or two 1 kW rod	Bronze, mushroom and cream	£2 19 0 (339) £3 12 11 (340)	£0 10 9 (339) £0 13 4 (340)
	" Loughton " LGH.337 and LGH.338	Pedestal reflector	1 kW (337) 2 kW (338)	One or two 1 kW rod	Maroon and dove grey and all-cream	£2 19 0 (337) £3 12 11 (338)	£0 10 9 (337) £0 13 4 (338)
	" Two-way " major LGH.341	Portable reflector	2 kW	Two 1 kW rod	Mushroom	£2 19 0	£0 10 9

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FAN HEATER

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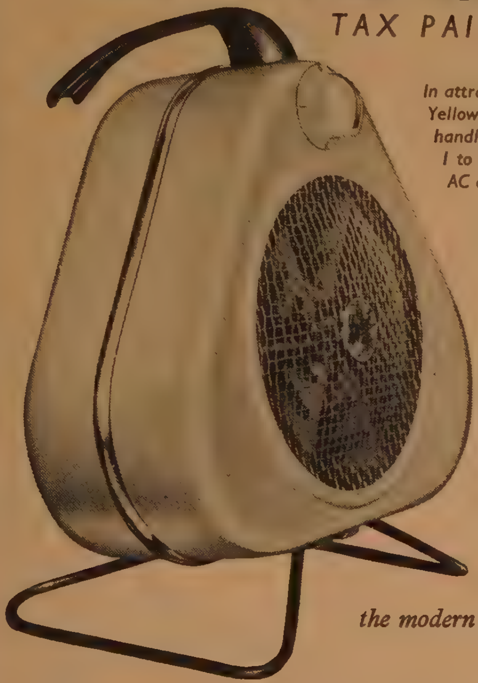

In attractive Primrose Yellow with Black handle and feet.
1 to 2 kW. loading
AC only.

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For each temperature setting.

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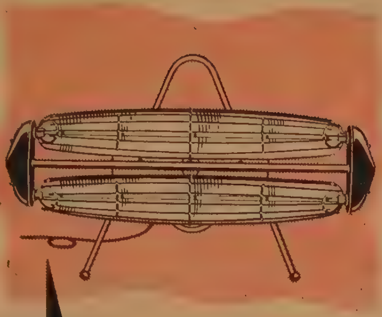

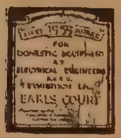

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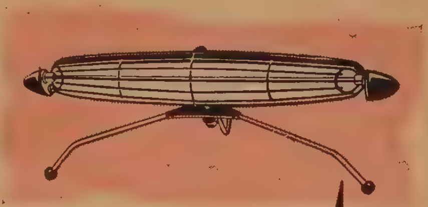

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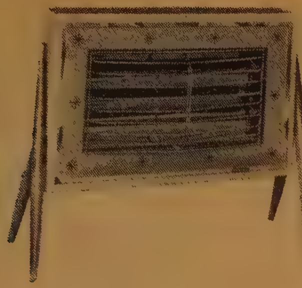
Tel: SOUTHAMPTON 74425-9 GRAMS: HEATEX, SOUTHAMPTON

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2. *(continued)*	" Florida " LGH.500	Combined reflector-convector	2½ kW	1½ or 2½ kW by means of switch	Golden bronze	£10 2 6	£1 17 0
	" Hawkins 800 " LGH.800	Imitation coal effect	2 kW	Two 1 kW rod	Gold or silver	£10 2 6	£1 17 0
HEATRAE, LTD., Heatrae Works, Norwich.	" Saferod "	Reflector, wall mounting	1 kW	One 1 kW embedded rod	Mushroom and chromium	£4 15 6	£0 17 6
	" Pilot "	Portable reflector	1 kW	One 1 kW rod	Ivory tan	£4 9 6	£0 16 5
	" Dandy "	Portable reflector	2 kW	Two 1 kW rod	Ivory tan	£8 2 0	£1 9 8
	" Majestic "	Reflector, floor mounting	2 kW	Two 1 kW embedded rod	Cameo fawn and pebble grey	£12 12 0	£2 6 1
	" Ballerina "	Reflector, floor mounting	2 kW	Three 660 W embedded rod	Cameo fawn and pebble grey	£12 12 0	£2 6 1
DAVID C. LESSER & CO., 510, Coventry Road, Birmingham, 10.	R/E505	Portable screen reflector	2 kW	Two 1 kW rod	Gold, green and cream	£4 4 8	£0 15 4
	C/506	Imitation coal effect	2 kW	Two 1 kW rod	Hammered gold	£7 16 0	£1 8 6
	SH1 and SH2	Wall mounting	750 W	One 750 W infra-red spiral	Cream or off-white	£3 11 3 (SH1) £4 8 0 (SH2–with switch)	£0 12 9 (SH1) £0 15 10 (SH2–with switch)
	R/T58/59	Portable reflector	1 and 2 kW	One or two 1 kW rod	Stoved enamel	£2 2 3 (1 kW) £2 16 8 (2 kW)	£0 7 8 (2 kW) £0 10 3 (2 kW)
	RI/F318 and RI/F320	Inset wall mounting	1 and 2 kW	One or two 1 kW rod	Stoved enamel, hammered	£1 19 4 (1 kW) £3 4 9 (2 kW)	£0 7 1 (1 kW) £0 11 8 (2 kW)
	RW/F304 and RW/F305	Rounded wall mounting	1 and 2 kW	One or two 1 kW rod	Stoved enamel, hammered	£2 10 6 (1 kW) £3 15 0 (2 kW)	£0 9 2 (1 kW) £0 13 7 (2 kW)
	WM507 and WM508	Angled wall mounting	1 and 2 kW	One or two 1 kW rod	Stoved enamel, hammered	£2 6 9 (1 kW) £3 10 0 (2 kW)	£0 8 6 (1 kW) £0 12 8 (2 kW)
LONOR, LTD., 1, Maddox Street, London, W.1.	" Siemens " SK15	Portable radiant heater	1½ kW	One 600 W and One 900 W rod	Brown/beige and blue/grey	£3 14 4	£0 13 5
	" Siemens " OFW1	Ceiling or wall mounting	1 kW	One 1 kW tubular sheathed	White enamelled base	£4 16 7	£0 17 5
	" Siemens " WST10A	Wall mounting	1 kW	One 1 kW rod	White enamelled	£2 10 8	£0 9 1
MARSDEN & BATESON, LTD., 67-69, Scholefield Street, Nechells, Birmingham, 7.	" Marbat " 1 and 2	Inset firebar	1 or 2 kW	One or two 1 kW bar	Hammered bronze or silver	£2 2 0 (1) £3 6 8 (2)	£0 7 8 (1) £0 12 2 (2)
	" Marbat " 3 and 4	Wall panel, firebar	1 or 2 kW	One or two 1 kW bar	Hammered bronze or silver	£2 13 9 (3) £4 0 10 (4)	£0 9 10 (3) £0 14 9 (4)
	" Marbat " bowl	Portable or wall mounting	600 W	One 600 W spiral	Copper *(a)* or aluminium *(b)*	£2 5 0 *(a)* £1 18 6 *(b)*	£0 8 3 *(a)* £0 7 0 *(b)*
METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Kemp Town, Brighton, 7.	" Magnaway "	Portable reflector	2 kW	Two 1 kW rod	Mottled silver and chromium	£3 10 0	£0 12 7
	" Mirrorway "	Portable bowl	750 W	One 750 W spiral	Plain aluminium	£1 1 9	£0 3 11
	"Astroway "	Portable bowl	750 W	One 750 W spiral	Plain aluminium	£1 5 3	£0 4 7
	" Marvelway "	Portable bowl	1 kW	One 1 kW spiral	Fluted aluminium	£1 13 3	£0 6 0
	" Superway "	Portable bowl	600 W	One 600 W spiral	Plain aluminium	£0 18 6	£0 2 8



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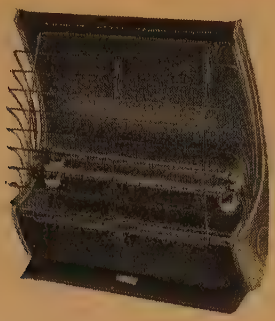

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20. *Heatrae " Ballerina " fire*

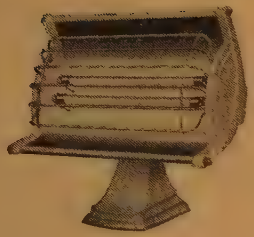
21. *Metway " Astroway " 750 W bowl fire*

22. *Simplex " Creda Cubana " 2 kW fire*

23. *T. B. Morley & Co.'s " Humber " reflector fire*

24. *M.E.M. " Memray " portable fire*

25. *Morphy-Richards " Avon " model FA/20*



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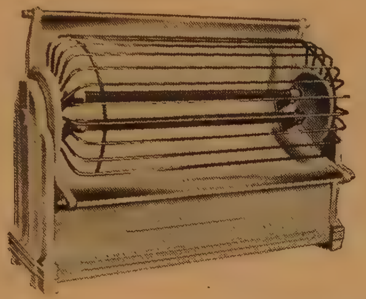

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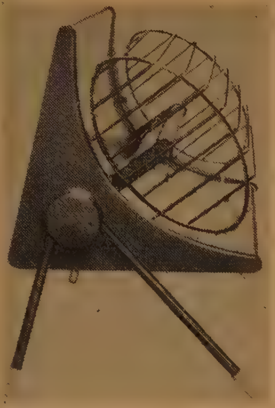
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
METWAY ELECTRICAL INDUSTRIES, LTD., **Canning Street,** **Kemp Town,** **Brighton, 7.** *(continued)*	" Modernway One "	Portable reflector	1 kW	One 1 kW rod	Chromium and white enamel	£1 15 0	£0 6 4
	" Modernway Two "	Portable reflector	2 kW	Two 1 kW rod	Chromium and white enamel	£2 12 6	£0 9 5
	" Rioway "	Portable reflector	750 W	One 750 W rod	Chromium and beige	£2 2 4	£0 7 7
MIDLAND ELECTRIC MFG. CO., LTD., **M.E.M. Works,** **Reddings Lane,** **Birmingham, 11.**	" Memray "	Wall mounting	1 kW	One 1 kW rod	Bronze or cream	£2 10 0	£0 9 2
	" Memray "	Portable, swivelled reflector	1 or 2 kW	One or two 1 kW rod	Bronze or cream	£2 19 0 (1 kW) £4 11 0 (2 kW)	£0 10 9 (1 kW) £0 16 8 (2 kW)
T. B. MORLEY & CO., LTD., **Jameson Street,** **Hull.**	" Don "	Portable reflector	750 W to 2 kW	One or two 750 W or 1 kW rod	Cream	£1 19 0 (750 W) £2 1 9 (1 kW) £2 8 6 (1½ kW) £2 12 9 (2 kW)	£0 7 1 (750 W) £0 7 7 (1 kW) £0 8 11 (1½ kW) £0 9 8 (2 kW)
	" Humber "	Portable reflector	750 W or 1,500 W	One or two 750 W rod	Cream	£2 0 0 (750 W) £2 8 6 (1½ kW)	£0 7 4 (750 W) £0 8 11 (1½ kW)
	" Derwent "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream	£2 0 9 (1 kW) £2 12 0 (2 kW)	£0 7 6 (1 kW) £0 9 6 (2 kW)
	" Thames "	Portable twin reflector	750 W or 1,500 W	One or two 750 W rod	Bronze	£1 3 3 (750 W) £1 15 9 (1½ kW)	£0 4 3 (750 W) £0 6 7 (1½ kW)
	" Severn "	Portable firebar	1 or 2 kW	One or two 1 kW bar	Bronze	£1 5 6 (1 kW) £1 18 3 (2 kW)	£0 4 8 (1 kW) £0 7 0 (2 kW)
	"Aire "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Cream	£2 0 0 (1 kW) £2 11 0 (2 kW)	£0 7 4 (1 kW) £0 9 4 (2 kW)
	" Morco " bowl	Portable reflector	600 W	One 600 W spiral	Cream	£1 8 6	£0 5 3
MORPHY-RICHARDS (CRAY), LTD., **50, Conduit Street,** **London, W.1.**	"Avon " FA/20	Portable reflector	2 kW	Two 1 kW rod	Pearl bronze, charcoal or ember red	£4 5 0	£0 15 4

Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
MORPHY-RICHARDS (CRAY), LTD., **50, Conduit Street,** **London, W.1.** *(continued)*	" Cray " FC/750 and FC/15	Portable reflector	750 W (FC/750) 1½ kW (FC/15)	One or two 750 W rod	Pearl bronze with red or pearl bronze with charcoal	£2 5 0 (FC/750) £2 15 6 (FC/15)	£0 8 2 (FC/750) £0 10 0 (FC/15)
	" Cray " FC/10 and FC/20	Portable reflector	1 kW (FC/10) 2 kW (FC/20)	One or two 1 kW rod	Pearl bronze with red or pearl bronze with charcoal	£2 10 6 (FC/10) £3 1 6 (FC/20)	£0 9 2 (FC/10) £0 11 1 (FC/20)
P. & R. ELECTRICAL (LONDON), LTD., **1, Berrymead Gardens,** **Acton, W.3.**	Elstein " Continental " 2	Wall mounting	600 W and 1 kW	Glazed sealed ceramic infra-red	Red, cream, black, turquoise or gold	£5 15 0	£1 0 4
	Elstein " Continental " 3	Wall mounting	900 W and 1½ kW	Glazed sealed ceramic infra-red	Red, cream, black, turquoise or gold	£8 4 6	£1 9 1
REELEK APPLIANCES, LTD., **Skimpot Industrial Estate,** **Luton,** **Beds.**	" Popular "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Mushroom	£1 0 0 (1 kW) £1 13 10 (2 kW)	£0 3 7 (1 kW) £0 6 1 (2 kW)
	" Minor "	Portable reflector	1 kW	One 1 kW rod	Mushroom	£1 12 0	£0 5 9
	" Viceroy "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Mushroom	£2 15 0 (1 kW) £3 7 3 (2 kW)	£0 9 11 (1 kW) £0 12 1 (2 kW)
	" Wizard "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Mushroom	£2 0 0 (1 kW) £2 10 0 (2 kW)	£0 7 3 (1 kW) £0 9 0 (2 kW)
	"Adjustable "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Mushroom	£2 5 0 (1 kW) £2 15 0 (2 kW)	£0 8 1 (1 kW) £0 9 11 (2 kW)
REMPLOY, LTD., **Oxgate Lane,** **Cricklewood, N.W.2.**	" Remploy " MH4/3, 4/4, 4/5 and 4/6	Portable reflector	750 W, 1 kW, 1½ kW and 2 kW	One or two 750 W or 1 kW rod	Stoved enamel, range of colours	£2 14 0 (750 W) £2 19 6 (1 kW) £3 6 0 (1½ kW) £3 12 3 (2 kW)	£0 9 11 (750 W) £0 10 11 (1 kW) £0 12 1 (1½ kW) £0 13 3 (2 kW)
REVO ELECTRIC CO., LTD., **Groveland Road,** **Tipton,** **Staffs.**	" New Reflexam "	Wall mounting reflector	1 or 2 kW	One or two 1 kW rod	Artshade silver and chromium	£3 8 6 (1 kW) £4 12 6 (2 kW)	£0 12 6 (1 kW) £0 16 11 (2 kW)
	" Somerset "	Portable firebar	1 or 2 kW	One or two 1 kW bar	Grey, green, yellow or red	£3 12 6 (1 kW) £4 17 6 (2 kW)	£0 13 3 (1 kW) £0 17 10 (2 kW)
	" Wessex "	Portable screen	2 kW	Two 1 kW rod	Grey, stone, red or gold	£6 13 0 (small) £6 16 0 (large)	£1 4 4 (small) £1 4 11 (large)
	" New Tubula "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Artshade silver and chromium	£3 10 6 (1 kW) £4 15 0 (2 kW)	£0 12 11 (1 kW) £0 17 10 (2 kW)
	" Contemporary "	Direct wall mounting	2 kW	Two 1 kW rods or bars	Grey, stone, red or gold	£13 4 0 (bar) £13 4 0 (rod)	£2 8 3 (bar) £2 8 3 (rod)
	" Crescent "	Portable reflector	2 kW	Two 1 kW rod	Grey, stone, red or gold	£3 1 6	£0 11 3
	" Swallow "	Wall mounting reflector	1 kW	One 1 kW rod	Blue with grey or yellow with grey	£3 6 6	£0 12 2
	" Glo-ray "	Imitation coal effect	2 kW	Two 1 kW rod	Grey, stone, red or gold	£11 15 5	£2 3 1
	" New Inset "	Inset with slabbing frame	1 or 2 kW	One or two 1 kW bar	Grey, stone, red or gold	£2 4 6 (1 kW) £3 3 0 (2 kW)	£0 8 2 (1 kW) £0 11 6 (2 kW)
	" New Inset "	Inset with slabbing frame	1 or 2 kW	One or two 1 kW rod	Grey, stone, red or gold	£2 7 6 (1 kW) £3 9 0 (2 kW)	£0 8 8 (1 kW) £0 12 7 (2 kW)
	" New Outset "	Direct wall mounting	1 or 2 kW	One or two 1 kW rod	Grey, stone, red or gold	£2 11 0 (1 kW) £3 11 0 (2 kW)	£0 9 4 (1 kW) £0 13 0 (2 kW)
	" New Outset "	Direct wall mounting	1 or 2 kW	One or two 1 kW bar	Grey, stone, red or gold	£2 14 0 (1 kW) £3 17 0 (2 kW)	£0 9 11 (1 kW) £0 14 1 (2 kW)



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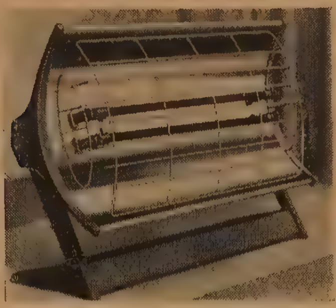

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26. *Sofono " Saturn " 2 kW reflector fire*
27. *Willet & Robinson "Miracoal" imitation coal fire*
28. *Remploy 2 kW reflector fire*
29. *Revo " Wessex " portable screen fire*
30. *Elstein " Continental " wall mounting infra-red heaters (P. & R. Electrical)*

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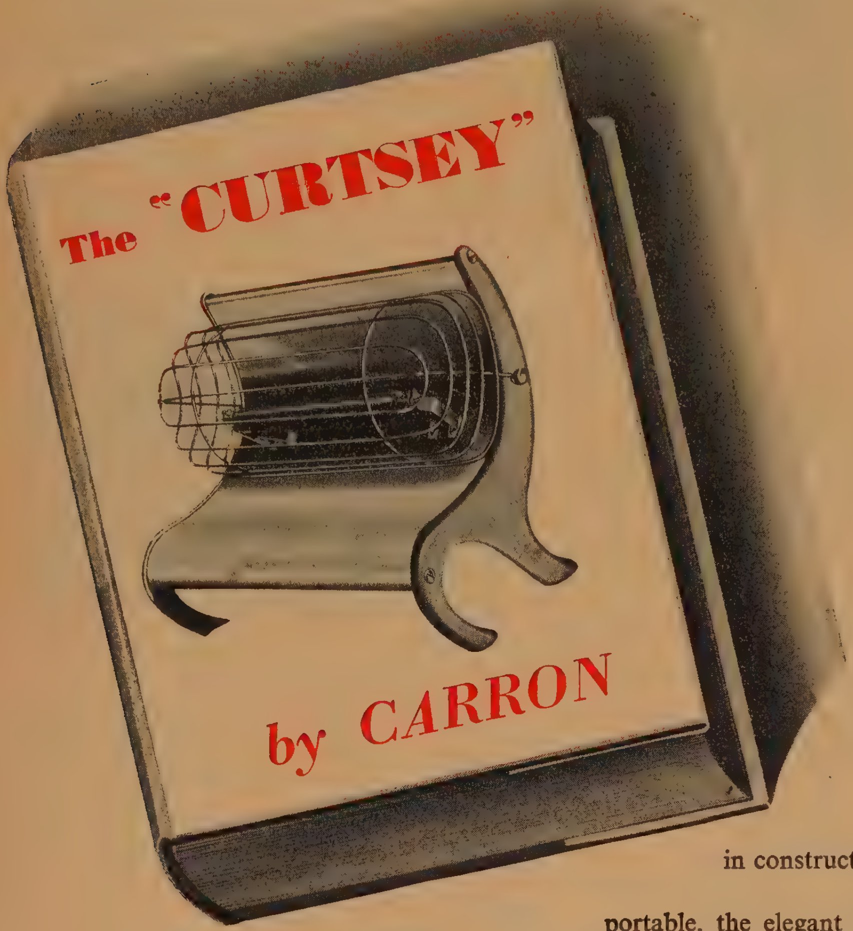
Manufacturer	Name or Model	Type	Total Loading	Elements	Finish	Price (excl. Tax)	Purchase Tax
REVO ELECTRIC CO., LTD., **Groveland Road,** **Tipton,** **Staffs.** *(continued)*	" Salisbury "	Convector fire	1 or 2 kW	One or two 1 kW rod	Grey, stone, red or gold	£6 17 5 (1 kW) £8 2 9 (2 kW)	£1 5 1 (1 kW) £1 9 9 (2 kW)
	" Salisbury "	Convector fire (thermostatic)	2 kW	Two 1 kW rod	Grey, stone, red or gold	£8 10 0	£1 11 0
	" Winchester "	Convector and radiant fire	2 or 3 kW	Two or three 1 kW rod	Grey, stone, red or gold	£9 1 9 (2 kW) £10 16 3 (3 kW)	£1 13 3 (2 kW) £1 19 6 (3 kW)
	" Winchester "	Convector and radiant fire (thermostatic)	2 or 3 kW	Two or three 1 kW rod	Grey, stone, red or gold	£9 9 6 (2 kW) £11 3 6 (3 kW)	£1 14 8 (2 kW) £2 0 10 (3 kW)
SIMPLEX ELECTRIC CO., LTD., **Creda Works,** **Blythe Bridge,** **Staffs.**	" Cubana " CH.352	Portable reflector	2 kW	Two 1 kW rod	Four two-tone colour schemes	£5 10 6	£1 0 2
	" Cresta " CH.357	Portable reflector	2 kW	Two 1 kW rod	Three two-tone colour schemes	£3 6 9	£0 12 3
SOFONO ELECTRICAL DIVISION OF FEDERATED FOUNDRIES, LTD., **4, Stratford Place,** **London, W.1.**	" Saturn "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Flame, mocha or pink	£2 16 0 (1 kW) £3 12 6 (2 kW)	£0 10 3 (1 kW) £0 13 3 (2 kW)
	" Mercury "	Portable reflector	1 or 2 kW	One or two 1 kW rod	Flame, mocha or pink	£3 16 0 (1 kW) £4 6 0 (2 kW)	£0 13 11 (1 kW) £0 15 9 (2 kW)
	" Jupiter " IRW.75 and IRW.150	Wall mounting	750 1,500 W	One 750 or 1,500 W infra-red spiral	Flame, mocha or grey	Prices on application	Prices on application
	" Jupiter " IRF.75 and IRF.150	Free standing portable	750 or 1,500 W	One 750 or 1,500 W infra-red spiral	Flame, mocha or grey	Prices on application	Prices on application
WILLET & ROBINSON, LTD., **Green Arrow Works,** **Maidstone, Kent.**	" Miracoal "	Imitation coal effect	2 kW	One or two 1 kW rod	Hammered gold or silver	£9 5 11	£1 14 0

ANOTHER BEST SELLER



Strong and robust in construction, light in weight and easily portable, the elegant lines of the "Curtsey" make it part of any furnishing scheme. The fixed reflector is heavily plated and the safety guard efficient and pleasing in appearance. List Price—**1kw £2.2.6 2kw £3.1.6.**

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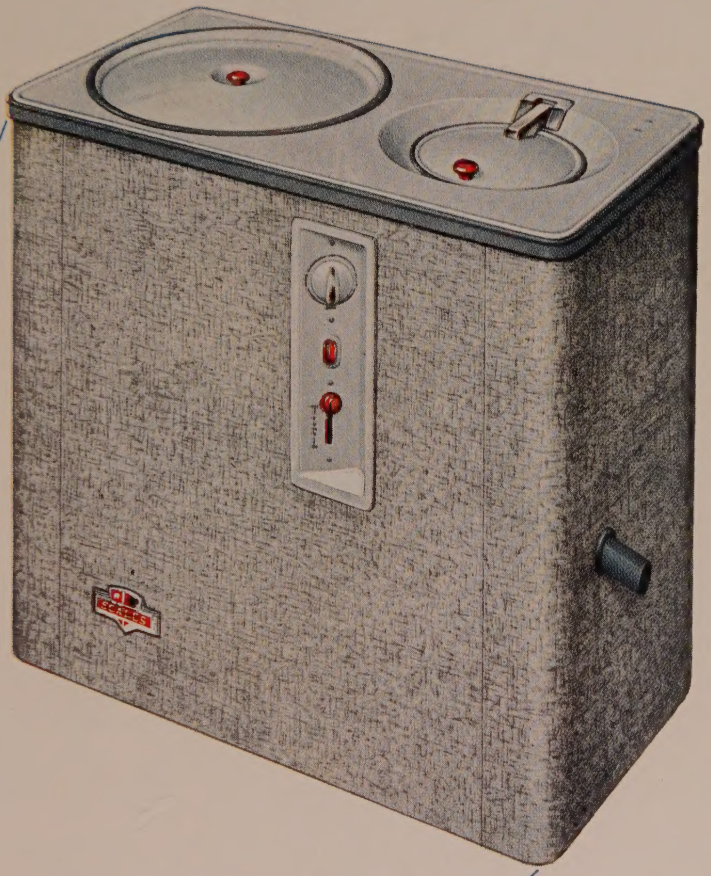
Stelvetite-plastic bonded to steel-has put a new face on the "Scales" Double Spin Units



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The illustration shows a "Scales" Double Spin Unit made from Stelvetite with the new tweed finish. All enquiries about the unit should be made to :
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